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COVER PICTURE

Apple orchards near Bridgetown make an attractive picture for the colour camera

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Fig. 1.—Apple orchards at Bridgetown. In the Bridgetown Road Board district there are 243,295 apple trees (1958 figures, Government Statistician). A recent widespread outbreak of codling moth in this district has been successfully eradicated

THE APPLE INDUSTRY
In Western Australia

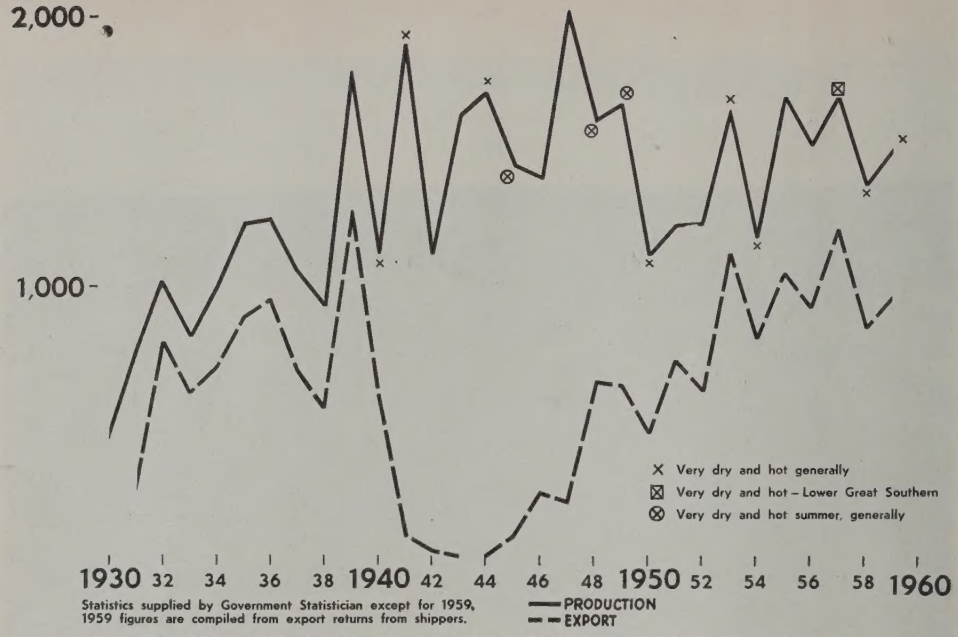
Some Developments over the Last Twenty Years

By H. R. POWELL, B.Sc. (Agric.), Superintendent of Horticulture

(A paper delivered at the annual conference of the Australian Apple and Pear Growers' Association, held at Albany July 1959.)

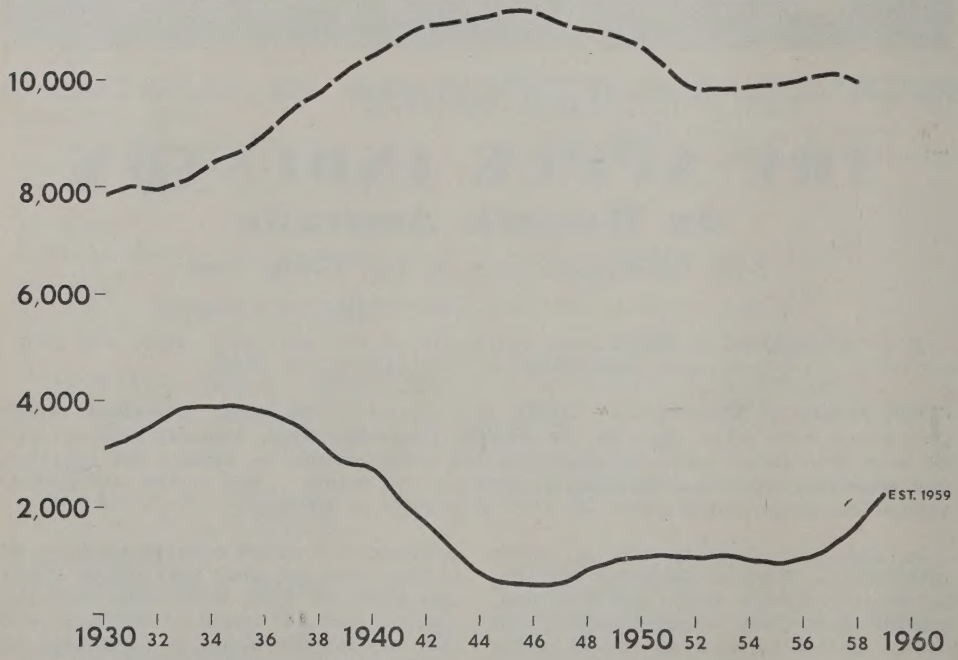
THE purpose of this paper is, briefly, to recapitulate the more important events which have taken place in the Western Australian apple industry over the last 20 years and in so doing to appreciate the achievements, to deplore the mistakes, and from the experience obtained, to plan for the future. The review will include various headings, and the first in order of priority is acreage.

In 1940, the bearing area of apple orchards in Western Australia was approximately 10,359 acres and the non-bearing area was approximately 2,739 acres, giving a total of 13,098 acres. At the present time, 1957-58, the total area is 11,618 acres, the bearing area 9,929 acres and the non-bearing area 1,689 acres. It will be seen from the overall picture that the total area under apples has fallen by 1,480 acres since 1940, the bearing area has fallen by 430 acres and the non-bearing area has decreased by 1,050 acres. Since the year 1955 there has been an appreciable annual increase in plantings and this trend is expected to


2,000
1,000
× Very dry and hot generally
⊠ Very dry and hot – Lower Great Southern
⊗ Very dry and hot summer, generally
1930 32 34 36 38 1940 42 44 46 48 1950 52 54 56 58 1960
PRODUCTION
EXPORT

Statistics supplied by Government Statistician except for 1959, 1959 figures are compiled from export returns from shippers.

PRODUCTION AND EXPORT. The figures at the left denote units of 1,000 bushels



Statistics supplied by Government Statistician
Since 1943–44, acreage based on 100 trees to the acre

APPLE ACREAGE. Graph showing acreage of trees in bearing (broken line) and non-bearing trees (black line) from 1930 to the present time

Fig. 2.—Granny Smith apple trees in flower on the orchard of Mr. W. Gregory, Bridgetown. This State is fortunate in being free from such serious apple pests and diseases as codling moth and apple scab, which require costly spraying treatments to ensure good quality fruit

continue. In 1958 sufficient apple trees were sold to plant 1,000 acres. Looking back, the total maximum bearing area of 11,247 acres occurred during 1946 and this time was also the lowest for non-bearing trees, namely 547 acres.

The reductions in planting were no doubt caused by the uncertainties of the future as far as export markets were concerned, the difficulties caused through the war, shortages of nursery trees and incidentally, the boom prices for wool.

This State had in the past relied almost entirely on Victorian nurserymen for the supply of fruit trees and this source of supply was closed in 1948 owing to restrictions on imports. It is very pleasing to point out that local nurserymen, after many setbacks, are now meeting the demand for trees.

PRODUCTION

Peak production occurred during the years 1941 to 1947 in the acquisition period; although these yields included tree measurement figures for some varieties, the high production did coincide with the maximum bearing acreage which occurred during the same period. The highest productions occurred in 1947, with 2,021,494 bushels, and in 1941 with 1,906,000 bushels.

During the twelve-year period since 1947, production has exceeded 1,500,000 bushels on seven occasions, the highest being 1,704,635 bushels in 1955. In the five off-years, production ranged between 1,117,000 and 1,359,458 bushels.

Although considerable numbers of bearing trees are old it is confidently expected that most will continue in production for a number of years to come. By the time they do go out, sufficient new plantings should be in production to maintain present yields. Any very favourable growing season would still boost production to over 2,000,000 bushels.

An important factor which it is difficult to assess at this stage is the effect of the new root-stocks. The earliest of these orchards are now in their tenth or eleventh

year and some are averaging ten bushels to the tree. It is quite likely that with the new stocks and with irrigation, significant increases in production can be expected in the years to come.

EXPORT

Over the 20 years under review, apple exports have definitely increased. The period 1941 to 1951 was affected by conditions arising from the war, lack of shipping space, etc., and exports were generally limited. From 1951 onwards, exports ranged from 604,197 bushels in 1952 to 1,290,160 bushels in 1957. The greatest quantity exported in the State's history occurred in the year 1939, when 1,301,295 cases were shipped. This was not a year of heavy production but the increase in quantities was brought about by exceptionally heavy rains during the summer months.

The principal varieties which are exported are Granny Smiths, Cleopatras, Jonathans, Yates, Dunns, Dougherty and Red Delicious. These are the main varieties grown in the State and they serve both the local and export markets. Red varieties are becoming more and more popular on the growing local market and it can be expected that export quantities will tend to be reduced in the years to come.

Cleopatras, Yates and Dougherty are being planted in only relatively small quantities and at the present time practically all the production is coming from old trees. There is a growing interest in Golden Delicious but it is difficult to say what the export trend will be. The variety is increasing in popularity on the local market and it will probably be some considerable time before greatly increased quantities will be available for export.

Almost all the fruit from this State is packed in redwood dump boxes made of karri or jarrah. Although standard boxes have been used there does not appear to be any trend towards their general use.

The quality of Granny Smith apples on overseas markets is of a high standard but unfortunately some complaints of bruising and overmaturity have been received regarding shipments sent late in the season.

CHANGE IN VARIETIES

In 1940, the four main varieties exported were, in bushels, Granny Smiths 213,396; Cleopatras 174,535; Dunns 56,076; Jonathans 55,933. The year previous, owing to unusually heavy summer rains, the quantities were much greater, namely, Granny Smiths 329,460; Cleopatras 303,452; Dunns 216,274 and Jonathans 191,590 bushels respectively.

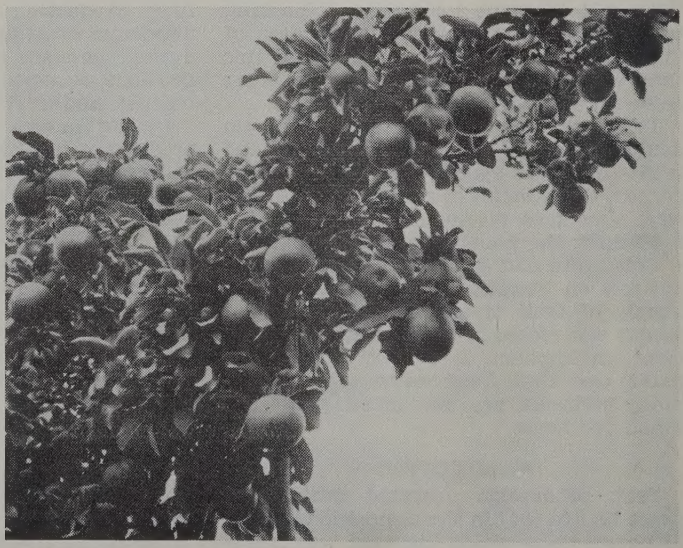


Fig. 3.—A limb of Granny Smith apples. This variety is widely planted in this State and production in a good year is in the region of one million bushels. Large quantities, up to 700,000 bushels, are exported and bring premium prices in the United Kingdom

Fig. 4.—A serious disease, apple scab. The specimens were taken from diseased trees at Manjimup prior to the commencement of a successful eradication campaign

Since 1951 when full-scale shipments were resumed, Granny Smith exports have greatly increased and the quantities of the other varieties have not changed very much. In 1957, over 700,000 Granny Smiths were exported, and in 1959 the quantity was 614,470. Since 1951, the only year in which exports were less than 400,000 bushels was in 1952 when 340,196 bushels were shipped.

There has been little change in the exports of Cleopatras, which were 174,535 bushels in 1940 and 163,414 bushels in 1959. The peak export of this variety in the period was 268,000 bushels in 1957.

With regard to Dunns, in no year have exports reached the relatively large figures recorded in 1939 when over 216,000 bushels were shipped. The position today appears to be that in the "on-year," total quantities are in the region of 80,000 to 90,000 bushels and in the "off-year" 20,000 to 25,000 bushels.

The position is much the same with Jonathans and in no year since have exports reached the 1939 level. Excepting the year 1953 when 99,566 bushels were exported, the normal range for this variety is between 26,000 and 81,000 bushels.

The importance of the Granny Smith apple to the Western Australian industry cannot be overlooked. Although total production figures are not available, the quantity grown must approximate in an "on-year" to a million bushels. The variety is well suited to the somewhat severe growing conditions often experienced during the summer months and it can benefit from rain during late March and April to a greater extent than other varieties.

THE ACQUISITION SCHEME

The Acquisition Scheme commenced in 1940 and terminated in 1951. This scheme was the salvation of the industry here as it was no doubt in Tasmania. A great deal of credit must be given to those responsible, and to the State Committee who managed local activities during the long difficult years when shortages of labour and materials, etc., were an everyday occurrence.

The executive members of the State Committee were G. Parke, (Chairman); R. M. Carter (Superintendent), and H. Soothill, later Deputy Chairman of the Apple and Pear Marketing Board.

During the early years of the Acquisition Scheme, growers were paid on quantities of apples determined by tree measurements. Many growers, with young orchards, found the temptation to leave fruit on the untipped leaders until the trees had been measured too great to withstand. Unfortunately the result was disastrous as many young trees broke down under the weight of fruit and never fully recovered. During the acquisition period with the exception of 1940, exports were greatly restricted.

During the critical years 1941-45 quantities did not exceed 82,640 bushels in any year.

Token shipments to the extent of approximately 200,000 bushels took place during 1946 and 1947. In 1948 and 1949 they rose to approximately 600,000 bushels, and fell back to 450,000 in 1950. Normal shipments resumed in 1951.

In an effort to utilise the surplus fruit to assist in the war effort, four apple dehydration plants were established, namely at Greenmount, Mt. Barker, Donnybrook and Bridgetown. In addition, large quantities of apples were used for juice extraction and for canning. Shipments of fresh apples were also made to the Eastern States. Every effort was made by the State Committee to promote the sale of fruit. Mobile units regularly visited suburbs in the metropolitan area and sold fruit at cheap prices. Country sales were encouraged but unfortunately bagged fruit suffered severely from bruising.

Before the war most growers were versed in the proper methods of sound orchard husbandry. When an interest in fruitgrowing was recreated after the war, many new growers found themselves ignorant of such basic requirements as proper care in the handling and the presentation of their fruit. They also were hampered by an almost complete absence of skilled labour for pruning, grafting, packing, etc.

WEATHER CYCLES

Weather cycles have varied a great deal and during the last 20 years there have been a number of exceedingly dry seasons; in fact, seven were generally very dry, an additional one was very dry in the Great Southern districts; further, on four occasions it was particularly hot and dry during the months of January, February and March. This means that out of the 20 years under review, 12 years have been hot and dry and a heavy toll of the industry's profits has been taken owing to undersized and sunburnt fruit.

Great progress has been made by growers in the provision of facilities for irrigation, which provide for essential insurance against losses through moisture stress, but there is a long way to go before the majority of growers will cease to be entirely dependent on natural growing conditions. It can be pointed out that in some years, owing to low winter rainfalls particularly in the Great Southern areas, dams and creeks were only partially filled and only limited quantities of water were available for irrigation.

DISEASE ERADICATION

The period has been notable from the pest and disease point of view in that there have been six large-scale outbreaks of codling moth, apple scab and oriental peach moth.

A new importation was the apple leaf hopper or jassid. It was first noticed at

Fig. 5.—An incident during the apple scab eradication campaign at Manjimup where flamethrowers were used to destroy possibly diseased fallen leaves caused by premature leaf-fall

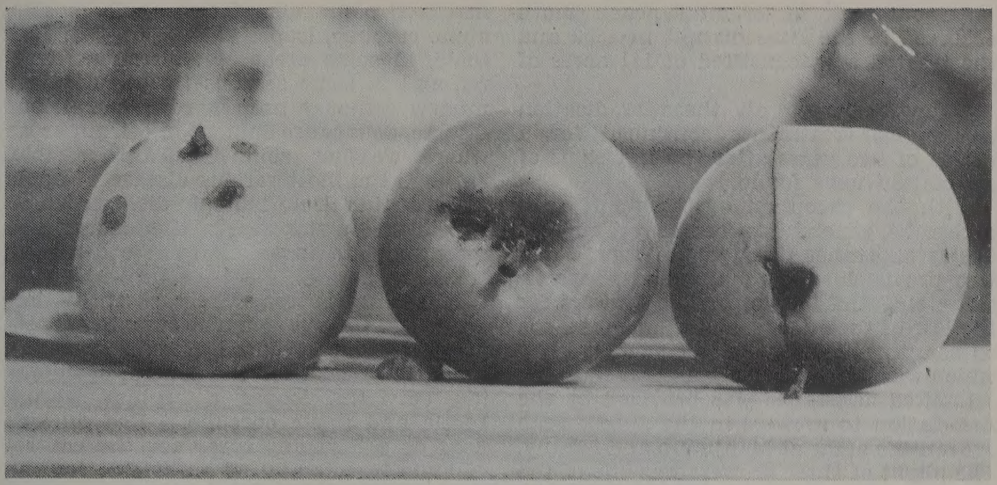


Fig. 6.—Apples damaged by codling moth—a serious pest of apples, pears and quinces. A number of outbreaks have occurred in the State and all have been successfully eradicated

Bridgetown in 1941 but unfortunately to such an extent that eradication was considered to be impossible. Tremendous damage was caused by this pest, particularly during the acquisition period when a number of adverse growing conditions were experienced. In recent years it has been adequately controlled by summer sprayings used against bryobia mite and red spider.

The outbreaks of apple scab, codling moth and oriental peach moth have been successfully eradicated by the efforts made by the Department and the growers concerned. The following is a brief summary of the outbreaks:—

During 1940, the disease "apple scab" was found in 25 orchards in the Manjimup district and three orchards in the Albany district. Growers suffered severely through the use of Bordeaux sprays russetting the fruit and by damage to the trees caused by moisture stress brought about by the prohibition of any cultivations until after Christmas. Although growers received payments through the Acquisition Scheme most of the fruit was classified as "good" grade and was paid for accordingly. Another severe outbreak of apple scab occurred during 1947 on young apple seedlings imported from Tasmania. A survey was quickly put into operation, and infested trees which were found on 20 commercial orchards, in two nurseries and in three backyard orchards were destroyed. It was obvious, from this experience and from other occasions when infested trees were found in nurseries, that the disease was being imported on young trees. On this account a prohibition was placed in 1948 on the importation of young apple trees; since that date no further signs of this disease have been found.

With regard to codling moth, outbreaks occurred at Collie in 1947, a large coal-mining town, at Mullalyup and Nannup in the South-West in 1951, and at Bridgetown in 1956. In Collie there were approximately 40 acres of pome fruit trees growing in backyard gardens. These trees were closely surveyed and many were bandaged, sprayed and "magpied" by departmental officers. In a number of instances buildings and fences close to infested trees had to be destroyed on account of harbouring hibernating larvae. It is pleasing to note that the compensation to the townspeople for the loss of fences and buildings was paid by the Western Australian Fruit Growers' Association through their Trust Fund.

The quarantine area at Nannup and Mullalyup amounted to 240 acres and the quarantine area at Bridgetown applied to approximately 60 square miles containing approximately 1,300 acres of orchards, producing approximately 270,000 bushels of pome fruits.

An outbreak of oriental peach moth occurred in the Hills district in 1952 and the treated area consisted of 141 acres of orchards.

With regard to all these eradication campaigns, treatments continued for a period of two years after the last signs of infestation were found.

With the exception of the apple scab outbreaks, generous governmental and industry assistance through the Trust Fund was provided to purchase plant, insecticides, etc., and to compensate growers for the loss of their crops, and in one instance as compensation for an old packing shed which was burnt to the ground at Nannup.

Limited assistance was provided by the Association to growers in the appple scab quarantine areas at Manjimup and Albany. The plight of these growers was one of the stimulations which produced the Trust Fund.

It can be expected that further outbreaks of codling moth will occur from time to time in the future and it is more than probable that given an even chance, eradication will be achieved.

DISEASES AND PESTS

Certain diseases and pests cause a great deal of trouble and they can briefly be listed as being nematodes, apple mosaic, apple curculio, looper caterpillar, San Jose scale, in some areas Mediterranean fruit fly, and in some seasons thrips. Powdery mildew, although not regarded as a serious disease, does cause damage in certain areas where weather conditions are suitable. Perhaps the most serious disease of apple trees in this State is apple dieback which is primarily a stoppage of the leaders, and secondly, an invasion by wood-rotting fungi.

It is only comparatively recently that apple trees received much spraying treatments. The standard insecticides were arsenate of lead for the control of climbing cutworm, looper caterpillar, spring beetle and apple curculio. Red oil was used as a dormant spray for the control of scale insects and as an ovicide for the control of bryobia mite. Lime-sulphur was used for the control of scale insects and in some instances for powdery mildew.

The introduction of so many new insecticides and fungicides has been somewhat bewildering to growers as it is difficult for them to counteract the arguments of a determined salesman. The materials Metasystox and Trithion have been most effective in the control of bryobia mite, red spider and apple jassid. Dieldrin has

Fig. 7.—An incident during the codling moth eradication campaign at Nannup. During this period large numbers of non-commercial trees were destroyed by Departmental officers. In the right foreground a deep pit has been dug to bury the fruit. The trees were destroyed by burning on account of harbouring hibernating grubs in loose bark, cracks, etc. A few trees were always left intact to ensure that the moths did not fly to clean orchards

Fig. 8.—A mobile spraying plant used to spray house orchards infested with codling moth. Similar plants were used at Collie, Nannup and Bridgetown

proved to be a potent defence against the apple curculio. DDT has never been popular among growers, although it was most effective for the control of the apple leaf hopper, loopers, etc. Red oils have been supplanted by superior oils and it is not certain to what extent they are superior. Lime-sulphur is still used for winter sprayings against San Jose scale and it is only on odd occasions that this material or Karathane are used for the control of powdery mildew..

Perhaps some reference should be made to fruit fly control. Two new baits consisting of Malathion and sugar, and Malathion and hydrolised yeast have recently been gazetted. When used experimentally, significantly better results were obtained, when compared to sodium fluosilicate.

Towards the end of the period there has been the introduction of the new soil fumigants, DD; Ethylene dibromide and Nemagon. These materials should prove to be of considerable value in controlling nematodes and in this direction the use of Nemagon around living trees appears extremely promising.

CROP LOSSES

As mentioned previously, severe crop losses have occurred during the period under review due to hot and dry weather conditions.

Unfortunately other crop losses have occurred from time to time due to hail, frost and thrips.

The Mt. Barker district has been probably the most unlucky district in this regard. Early in 1951, a severe hailstorm reduced export quantities by approximately 100,000 bushels and later in the same year thrips more or less ruined crop prospects for the following year. In addition, since 1951, severe dry weather has reduced yields in almost all the on years.

Other districts have been more fortunate as crop losses due to hail were restricted to relatively small areas. The greatest loss was through frost damage in 1944.

STOCKS

Up until 1948, the main stock in this State was Northern Spy. Since 1948, when imports were prohibited from outside the State, the two stocks now being mainly used are root grafts and seedlings, with more trees on root grafts than on seedlings. Many of the orchards on these stocks are in their tenth or eleventh year and are showing great promise with regard to tree growth particularly when irrigated. Bearing however, has been delayed but it does

appear that these stocks generally, are superior to Spy. They have the disadvantage however, that the trees being larger are more susceptible to dry growing conditions.

One nurseryman is selling small quantities of trees this season on M.793. The stock does well in New Zealand and Queensland.

INVESTIGATIONS

Considerable investigations have been made into the problems affecting apple trees, principally the disease known as apple dieback. Although significant advancements in knowledge have been obtained, the fundamental causes have not yet been ascertained. Investigations are now in progress on the secondary phases of the problem, namely, the control of wood-rotting fungi. In the near future it is intended to initiate full-scale trials on the primary cause mainly directed into soil management, control of nematodes and apple curculio. The acquisition of the Stoneville Research Station in 1955 has now made it possible for the commencement of more comprehensive and detailed investigations and during 1961 a rootstock trial will be planted. All the most promising rootstocks have been obtained and they will be used with suitable scion varieties. The purchase of the research station highlights the co-operation which exists between the Western Australian Fruit Growers' Association and this Department. Owing to the purchase price from the vendor being much greater than the taxation value offered by the Department, the Association made up the difference of £2,843. Despite the fact that investigations have been affected by the lack of suitable facilities, a great number of experiments have been conducted on growers' properties on such matters as the control of insect pests and nematodes, fertilisers, stop drop sprays, soil mulches, chemical thinning etc., etc. In this particular sphere considerable progress has been made since 1940 and it is confidently expected that with the research station in operation significant results of value to industry will be achieved in the years to come.

It is also pertinent to point out that storage experiments with Granny Smith apples have been highly successful in controlling superficial scald by the dual temperature method and by delayed harvesting.

Important advances have also been made in the use of polythene liners for the successful storage of Yates apples, and Bartlett and Packham pears.

COLD STORAGE

During recent years many small cold stores have been established on grower's properties, particularly in the Hills and Donnybrook districts.

Fig. 9.—Bulk-handling of apples on the orchard of Mr. R. Grist, Donnybrook. This grower and Mr. R. Crouch of Kendenup pioneered this method of harvesting in this State

Fig. 10.—Propagation of apple trees on various rootstocks in the nursery, Stoneville Research Station. The first experimental planting of apples will be made during 1960

BULK HANDLING

Bulk harvesting commenced three years ago when two growers adopted the practice with considerable ingenuity to meet their own particular requirements. They were Mr. R. Grist of Donnybrook and Mr. R. Crouch of Kendenup.

During 1958, two central packing sheds at Donnybrook erected by Westralian Farmers Co-op. Ltd., and Tropical Traders & Patersons Ltd., made considerable progress in commercial experiments and during 1959, the practice was adopted on a much more general scale by both growers and central packing sheds.

Although bulk containers or bins holding approximately 25 bushels of unwrapped fruit of mixed sizes, 2¼ in. to 2¾ in., were used in Tasmania for export purposes to the United Kingdom on a small scale during 1958 and more generally during 1959, the new method of packaging for export was slow to commence in this State. Only one export firm, the Mount Barker Co-op., participated to the extent of shipping six bins towards the close of the last export season.

LEGISLATION

The most important legislation affecting the apple industry are the Plant Diseases Act, the Fruit Growing Industry Trust Fund Act, the Agricultural Products Act and the Fruit Cases Act. Under the Plant Diseases Act power exists to cope with the outbreaks of disease which occur from time to time, and provision is made for the inspection and treatment of imported plant material. A very significant section of the Act deals with annual orchard registration fees and these apply to both commercial and non-commercial orchards. Backyard growers are required to register and the minimum fee is 2s.; should they have more than 24 trees the registration fee is 5s. The registration fee for commercial orchards of one acre and greater is 5s. per acre or part thereof. The money collected from orchard registration fees is placed into a special Trust Fund and is used entirely for the payment of salaries and expenses of fruit fly inspectors, printing, etc. This Fund is considerably augmented by advances from Government sources to subsidise Compulsory Fruit Fly Baiting Schemes, etc. Provision for the establishment of these schemes is also made under the Act; there are three in operation at the present time. Significant advances in fruit fly control will commence this year by a joint arrangement with the Western Australian Fruit Growers' Association and the Department. The Association has decided to make available monies from the Trust Fund and have voluntarily agreed to increase the commercial registration fees from 2s. to 5s. The extra money, which will be subsidised on a £1-for-£1 basis by the Department, will be used for publicity purposes, research, and the appointment of additional staff.

The Fruit Growing Industry Trust Fund Act was passed in 1942 and the Fund has now reached a high figure. It has been used in the past to cover the expenses of the Association and very significant contributions have been made from it to recoup losses to growers involved in disease and pest eradication. The establishment of this fund is a major advance and has made possible the eradication of the disease outbreaks without severe financial loss to the growers involved.

Grading regulations are provided for apples under the Agricultural Products Act, and fruit cases are specified under the Fruit Cases Act.

PERSONS

The fruit growing industry has been fortunate in having over the years capable representatives who have held their own in the many Government and Industry conferences which have taken place. First and foremost is the President, M. J. McNeil Martin, M.B.E., who has occupied this position over the last 25 years. He has been ably assisted by others who have made great contributions to the well being of the industry.

The Fruit Branch of the Department has changed a great deal since the beginning of 1940 when the late Mr. G. W. Wickens retired. Officers who have been with the Department and who are now performing important duties elsewhere include Mr. R. C. Owen, M.L.A., who is Chairman of the Central Citrus Council of this State; Mr. T. C. Miller, who is now Chief Horticulturist with the Department of Agriculture, South Australia; Mr. W. J. Bettenay, who is Supervisor, Fresh Fruit Exports with the Department of Primary Industry, Melbourne, and Mr. S. de Beaux, who is Fruit Officer in London with the Department of Primary Industry. Although the Department has lost the services of these ex-officers, it has been fortunate in obtaining replacements who are now doing sterling work for the industry.

Throughout the period a number of overseas visits have been made to obtain experience in marketing, extension and research in other countries.

The Superintendent of Horticulture visited Singapore in 1947 and acted as Australian Fruit Officer in London during 1949. Mr. H. J. Price of the Illawarra Orchard Co., Karragullen, visited Canada and the United States of America during 1954. This year Mr. F. Melville, a senior officer of the Horticultural Division, has acted as Assistant Fruit Officer in London and is now in America for several months.

CONCLUSION

The Apple Industry in this State, which was showing signs of slowing down in 1940, was still further handicapped by the conditions arising from the war. At the end of hostilities, trees, materials and labour were in short supply. The high price for wool and other primary products caused

Fig. 11.—Results of a storage experiment with Granny Smith apples; top row is affected with superficial scald and the bottom row is free; much storage research has been done and recommendations are now available to reduce the incidence of this serious disorder

Fig. 12.—Some of those who attended the 1942 Annual Conference of the Western Australian Fruit Growers' Association (Inc.). Most of these men played an important part within the industry and some are still doing so. Unfortunately the ranks have been thinned by time

Front row: T. Skinner; the late T. G. Sounness; J. McNeil Martin—President (recently honoured by the Queen for his services to the industry); J. Cross; E. S. Hester

2nd row: L. Hill; R. M. Carter; the late F. Kamman; H. R. Powell, Superintendent of Horticulture; R. Wallace; W. Cansdale; the late A. Chately; the late Mr. Samson, M.L.A.

3rd row: H. Lake; T. C. Miller—now Chief Horticulturist, Department of Agriculture, Adelaide; the late B. Hickling; the late A. Machin; the late O. A. K. Sounness; C. R. Moore

4th row: G. Parke; F. Hawter; the late J. McAlinden; H. Clothier; ————

5th row: S. Bennett, Horticultural Instructor; the late T. Ilbery; the late T. Howatson; the late J. Brindle, ————, M. W. Wright; W. Gibb; H. J. Price; ————; ————; the late W. Boon.

a lack of interest in apple growing and many orchards, particularly in marginal areas and in the Lower Great Southern, were allowed to deteriorate. This trend is now changing with the fall in price of wool and more interest is being shown in orchards. The most significant changes have taken place in the Hills, Donnybrook and Manjimup districts.

The attached table shows areas of apple orchards in some key Road Board districts in 1940 and in 1958: With regard to diseases and pests, the industry has been fortunate in safeguarding its position against the establishment of codling moth, oriental peach moth and apple scab. On the other hand, an important pest, the apple leaf hopper has been introduced.

A solution to the problem of apple dieback has not yet been obtained but fortunately there are indications that a solution is in sight.

Of the other pests and diseases, effective control measures are available except for the virus disease, apple mosaic. Efforts are being directed to the establishment of virus-free material which it is hoped will be made available to nurserymen for future plantings.

The establishment of the research station at Stoneville is a major advancement and will do much to clarify many of fruit growers' problems.

Important advances have been made in controlling superficial scald of Granny Smith apples and with the use of plastic liners for the storage of certain varieties of apples and pears. There have also been significant advances in cold storage facilities, and many small cold stores have been established on growers' properties.

Again, there have been spectacular changes in harvesting by the adoption of bulk handling methods, resulting in less

bruising and lower costs. Central packing sheds have in most instances made the necessary adjustments to handle the bulk containers. The use of bulk bins for export has also commenced and this method can easily revolutionise existing shipping practices during the next few years.

Certain legislation has been mentioned as being of particular importance to the industry and the advantages which have been obtained in the past should apply to the future.

The organisation of the industry is on sound lines and there is an organisation known as the Advisory Council to discuss mutual problems. This Council consists of representatives of growers, shippers, and the Department of Agriculture.

There have been important changes in the mechanisation of orchards. The era has seen the disappearance of the horse and its replacement by tractor. More efficient spraying plants have been obtained and growers are thus better equipped, than they were in 1940.

From the growing point of view it is clear that at the present time a large proportion of the apple trees are old and are incapable of producing a crop in excess of 1,700,000 bushels, except under favourable weather conditions. However, with the increased facilities for irrigation and post-war plantings of more vigorous stocks, production can be expected to increase in the future.

Generally, it can be said that progress over the last 20 years, measured by production, has not been spectacular, but important achievements have been realised in the eradication of pest and disease outbreaks and it can safely be said that progress in the future, if there are no world calamities, will be steady and certain.

NUMBERS OF APPLE TREES IN SOME KEY ROAD BOARDS IN 1940-1958

	DARLING RANGE			PRESTON			BRIDGETOWN			WARREN			PLANTAGENET		
	Bearing	Non-bearing	Total	Bearing	Non-bearing	Total	Bearing	Non-bearing	Total	Bearing	Non-bearing	Total	Bearing	Non-bearing	Total
1940	11,142	9,501	20,643	99,322	33,638	132,960	197,481	50,774	248,255	83,984	36,343	120,327	244,500	42,554	287,054
1958	25,119	16,304	41,423	119,563	38,765	158,328	209,829	24,466	234,295	125,428	34,089	159,517	207,368	6,899	214,267

NEW FLAX VARIETY RELEASED

A new flax variety named "Forrest," which is resistant to all known strains of flax rust, has been released to flax growers for cultivation in the Boyup Brook area.

The new variety was developed by selection from an introduced variety known only as D.83, and is an excellent flax type with fine, medium tall straw and a good seed-head. It is a sparsely-tillering variety with medium to good straw strength.

During the last five years experimental bundles of straw have been processed and the fibre quality assessed by the Blackwood Flax Co-op. Co Ltd. In 1958 an acre was grown on Mr. J. Hands' property, and enough seed was obtained to sow 10 to 12 acres on the same farm this year.

"Forrest" is equal to present standard varieties such as "Wada" and "Boyup" in respect to yield of straw, fibre yield and fibre quality. It is superior in rust-resistance and therefore should prove a valuable new early-maturing variety for growing in the Boyup Brook area.

AVON-An Oat Variety Resistant to Manganese Deficiency

By W. J. TOMS, B.Sc. (Agric.), Research Officer, Plant Research Division

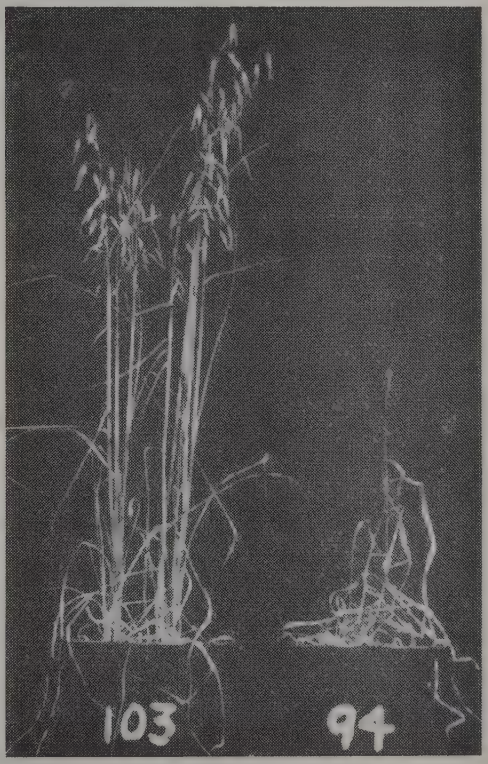
IN previous issues of "The Journal of Agriculture" (May-June, 1958, and September-October, 1958) attention has been drawn to the apparent resistance of the oat variety Avon to manganese deficiency. A glasshouse experiment carried out in 1958 showed that when manganese deficiency is severe, the variety Avon outyields the varieties Algerian, Fulghum, Ballidu and Dale.

All varieties contained similar total amounts of manganese in their tops and it is therefore probable that Avon shows some internal resistance to the deficiency.

Of the varieties tested, Dale was the most susceptible to manganese deficiency. It would be unwise therefore to sow this oat on land suspected of manganese deficiency.

Manganese deficiency generally occurs unevenly throughout affected paddocks so that although an application of manganese sulphate at 14 lb./ac.* gives large increases in yield on manganese-deficient land, deficiency symptoms are not completely cured on the acutely deficient patches. It could be expected therefore that the use of Avon would give an increase in yield on acutely deficient land that has been treated with manganese fertiliser. Avon should also be of benefit on land that grows a deficient crop only in certain seasons, and is not deficient enough to warrant application of manganese when cropped.

It is stressed that for land on which manganese fertiliser is normally used, the manganese should still be applied when the variety Avon is sown. In 1958 an experiment with rates of manganese sulphate on Avon oats at Moulyinning showed an increase of 6 bush/ac. with the highest rate (42 lb./ac.). This is an appreciable increase considering that the wet season tended to lessen the severity of the deficiency.



Contrast in growth of Avon and Dale oat varieties in a soil supplying only small amounts of manganese. Avon is in pot 103

* Half a bag of manganese super contains 14 lb. of manganese sulphate.

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DOSING FARM ANIMALS

By J. A. MALLETT

EVERY year, many valuable animals are lost through illnesses which could have been prevented, or checked in the early stages, by the timely administration of suitable medicines. It is unfortunate that far too many stockowners, either through lack of knowledge or other causes, tend to postpone the dosing until it is too late for the drugs to be fully effective.

Most animals, particularly those which frequent handling has rendered reasonably docile, can be dosed easily by methods which have been in vogue for many years. Even unbroken stock can usually be dosed by these methods plus some simple form of restraint such as a suitable crush or bail, hobbles, sidelines, etc.

For the qualified veterinary surgeon, stock dosing is a fairly simple matter, for he has access to drugs and equipment not usually available to the layman, but as many of our flocks and herds are depastured in areas where professional assistance is not readily obtainable it is hoped that these notes will assist the stockowner compelled to adopt "do-it-yourself" methods.

SHEEP

Most sheepowners are familiar with the hypodermic syringe, used principally for administering vaccines and anti-toxins. A fairly wide range of drugs may now be given by hypodermic injection but these are largely restricted to veterinarians.

Many sheep medicines can be given in the form of drenches, and several types of syringes and drenching-guns are now available to facilitate the operation. The most popular models are those which automatically eject a measured dose and refill ready for the next sheep.

When using these drenching guns, care must be taken not to injure the sensitive membranes of the sheep's mouth and throat. This occurs most frequently if the nozzle of the gun becomes damaged and is left with a rough surface.

In some popular automatic drenching guns the dose is discharged through a plastic tube which extends into the oesophagus or gullet of the sheep. This is a useful feature in minimising staining of the wool when phenothiazine worm drenches are used.

Similar automatic guns are available for administering capsules and pellets, such as the "cobalt bullets" recently introduced by C.S.I.R.O. workers.

Individual sheep may be drenched from a bottle, or a powdered medicine may be given as an electuary—mixed with treacle or molasses and smeared on the back part of the tongue by means of a smooth flat piece of wood. Electuaries may be used for dosing most types of livestock.

HORSES

For drenching horses, a specially-made drenching-bit is a good investment. This is a length of hollow tube closed at one end which fits into the mouth like an ordinary bit and is held in position by a leather headstall passing over the horse's head. A small funnel fits into the open end of the tube, and liquid poured into the funnel finds its way into the horse's mouth through one or more holes in the bit

A metal nose-piece, shaped like an inverted U, carries a loop or eye so that a cord can be passed through it and over a rafter to hold the head up.

To drench a horse, the animal should preferably be backed into a stall, the head raised and the drench given a little at a time.

Don't haul the horse's head up until the nose is pointing skyward. The head should never pass the horizontal position.

Don't pinch or punch the throat in an endeavour to make the horse swallow.

Don't tie the head up; pass the cord loosely over a hook or rafter so that if the horse attempts to cough, its head can be lowered immediately.

Don't rush. Give the drench in small quantities and give the horse time to swallow. Medicines which "go the wrong way" and finish in the lungs can lead to pneumonia.

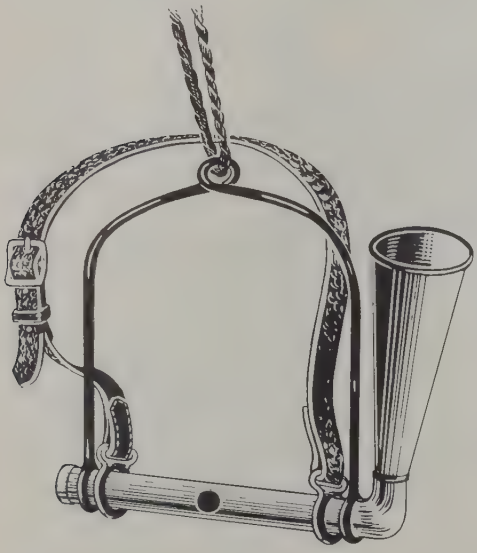

Fig. 1.—A drenching bit

Don't try to drench through the nostril. Anything entering the nostril is likely to go direct into the lungs.

Where a drenching bit is not available, it is a simple matter to drench with a bottle. Special metal drenching-bottles were commonly used, but a glass bottle is quite satisfactory if reasonable care is taken.

Introduce the neck of the bottle into the corner of the horse's mouth between the cheek and the teeth. Pour in a little of the liquid and give the horse time to swallow it before giving any more. A hand under the lower jaw will keep the head up if the horse is a quiet type. Failing this, use a strong halter and pass a rope through the nose-band and over a beam.

Balling a Horse.

Many horse medicines are given in the form of "physic balls." These are gelatine capsules, oval or cylindrical in shape, containing drugs in powdered form. The ball is swallowed whole and on reaching the stomach, the gelatine dissolves, releasing the dose.

The "balling pistol" shown in the illustration is a handy aid to administering a ball, and was a common article of stable equipment in the days of horse-teams. The ball fits into the cup and is ejected by pressure on the end of the plunger which slides freely inside the barrel. In giving the ball, it was usual to slip the left hand into the horse's mouth, grasp the tongue from above and then turn the hand so that the thumb was pointing upward and pressing against the roof of the mouth to keep it open. The barrel of the balling pistol was then pushed well in towards the root of the tongue, the ball ejected and the horse's tongue released.

A good substitute for a balling pistol is a length of suitably-sized hose with a piece of cane or dowel-stick to serve as the plunger.

Where a mouth-gag is available, it is a simple matter to give the ball by hand as with the gag in position, the ball may be pushed well to the back of the tongue where the horse can swallow it easily.

Giving a ball without any special equipment is a task which looks simple when

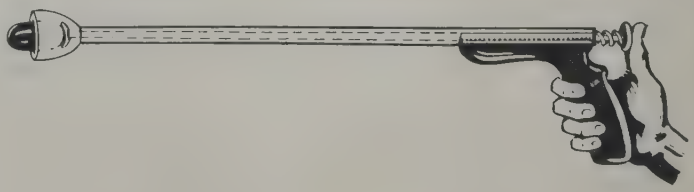

Fig. 2.—A balling pistol

Fig. 3.—A crude but effective method of drenching a large pig

performed by an expert but calls for considerable skill and perfect timing.

The tongue is grasped as described earlier and the horse's mouth held open. With the ball held in the tips of the first, second and third fingers, the right hand is thrust quickly towards the root of the tongue, the ball pushed well back towards the gullet and the tongue released.

Unless the ball is placed correctly, the horse usually spits it out again. Subsequent attempts with the horse becoming increasingly hard to control and the ball becoming more and more slippery are seldom successful.

CATTLE

Dosing cattle usually requires some form of restraint such as bails and/or crushes. Occasionally, the medicines may be given in the form of electuaries—mixed with treacle and smeared on the tongue—but in most cases a drench is necessary.

Quiet dairy cattle may usually be drenched easily if two people are available One person grasps the horns and raises the head slightly. The other handles the bottle, allowing a portion of the drench to run into the mouth. A thumb and forefinger in the nostrils or the use of nose-grips are sometimes helpful. Polled cattle should be haltered for easy drenching.

Cattle seldom spit out a drench once it is in the mouth and it is a simple matter to give the drench in small doses of a quarter of a pint at a time. Once the dose has gone into the mouth, the cow's head may be released to facilitate swallowing.

PIGS

Drenching pigs generally entails a strenuous course of catch-as-catch-can wrestling accompanied by a chorus of ear-torturing squeals so it is fortunate that most pig medicines can be given in the feeding-troughs, mixed with some sloppy food.

If the animals are starved for about 24 hours they will usually gulp down even unpleasantly-flavoured drugs in milk or sloppy pollard mixtures.

The time-honoured method of drenching a large pig by using an old boot with a hole in the toes is quite satisfactory. Pass a slip-knot round the top jaw behind the tusks and pass the end of the rope over a rail so the head is slightly raised. Push the toe of the boot into the pig's mouth and pour the medicine slowly into the boot as he chews at it. An assistant straddling the pig and holding the ears will help to keep him in the required position.

An improvement on the boot is a piece of wood about 18 in. long and two to three inches in diameter with the ends shaped into handles. A hole, big enough to take the neck of a bottle, is drilled through the centre.

Fig. 4.—A simple aid to pig drenching

The assistant straddles the pig holding the piece of wood in the animal's mouth like a bit. The bottle neck is placed in the hole and the drench given slowly.

DOGS AND CATS

The dosing of dogs and cats often presents some problems. Pills may be given in pieces of meat and powders can be mixed into butter or dripping—always provided that the animal is not so sick that its appetite is impaired.

Don't open a dog's mouth to give him a liquid medicine. Have the medicine in a small bottle such as is used for aspirin tablets. Pass one finger into the corner of his mouth and press the cheek outward to form a pocket into which the liquid can be poured. This can be done even when the dog is wearing a muzzle—which is always advisable when dosing a vicious animal. Keep the head slightly raised to encourage swallowing.

Cats should be rolled in a cloth or bag to prevent their claws from coming into action and can then be compelled to swallow small tablets or liquid medicines by the following method.

Place the hand at the back of the cat's head so that the head fits into the U formed by the thumb and forefinger—or the thumb and middle finger. Press the cat's cheeks inward so that the animal opens its mouth and cannot close its jaws without biting its cheeks. A tablet placed on the cat's tongue can now be poked to the back of the throat with the little finger of the other hand, or a small quantity of liquid can be introduced by means of a teaspoon, eye-dropper or small bottle.

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GOLDSBROUGHS

INSECT Pests AND THEIR CONTROL

By C. F. H. JENKINS, M.A., Government Entomologist, and
D. G. SHEDLEY, B.Sc. (Agric.)

THE MEDITERRANEAN FRUIT FLY

THE Mediterranean fruit fly *(Ceratitis capitata* Wied) is without doubt the most serious insect pest with which Western Australian orchardists have to contend. Its ravages can, however, be greatly reduced if control measures are applied correctly.

The creature has been known to science for nearly 140 years, and in that time has spread to almost every important fruit-growing country in the world.

In this State the insect is known as far north as Carnarvon, where it was first found in 1934. The permanent home of the pest, however, may be regarded as that area of the State westward of a line running from Gingin south-eastwards to include Northam and York, and thence southwards to Balingup and Busselton. Seasonal outbreaks occur at Bridgetown, Albany, Mt. Barker, Kalgoorlie, Sandstone, and other outlying localities, where the pest has failed to become established.

In the case of the southern fruitgrowing areas, failure is probably due to the stringent control measures adopted and relatively unfavourable climatic conditions, whereas in other districts the scarcity and lack of continuity of suitable host fruits accounts for its spasmodic appearances.

Fig. 1.—Adult female of Mediterranean fruit fly (greatly enlarged)

DESCRIPTION AND LIFE HISTORY

The Adults.

The Mediterranean fruit fly is a two-winged insect a little smaller than the house fly. The general colour is yellowish or light brown. The wings bear brownish bands and spots, and the abdomen has two light coloured rings. The pattern on the thorax or back consists of irregular white markings on a black background, giving a mosaic appearance. In the sunlight this pattern often shows a metallic sheen. The wings are normally held in a drooping and what appears to be a semi-spread position, and are never folded flat on the back as in the case of the housefly.

Mating and egg-laying does not take place in the young flies until they are about a week old.

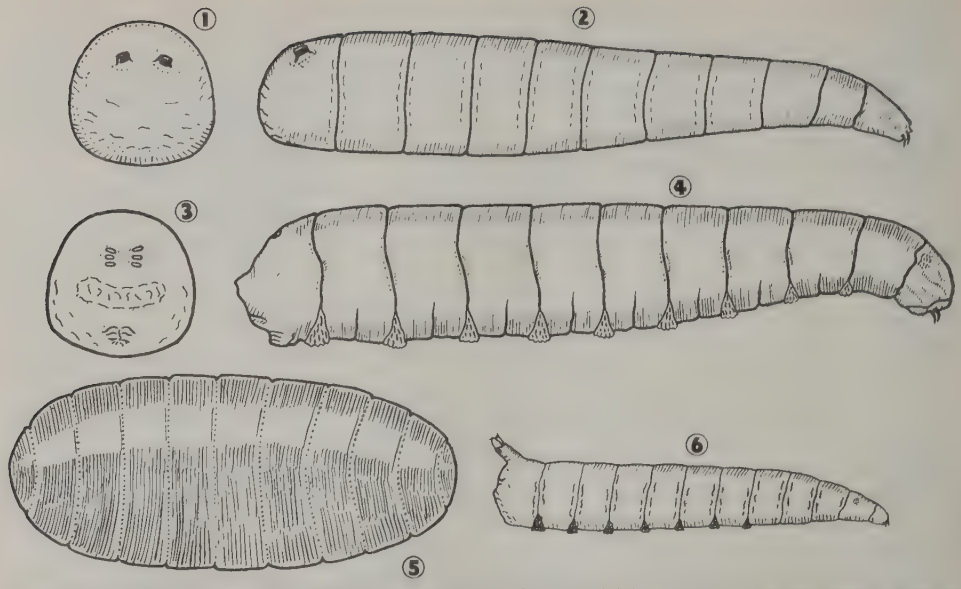

Fig. 2.—1 and 2, Side and end views of larva of tomato fly *(Lonchea splendida)*; 3 and 4, Side and end views of larva of Mediterranean fruit fly (*Ceratitis capitata*); 5, Pupa of Mediterranean fruit fly; 6, Larva of ferment fly (*Drosophila* sp.)

During this period the flies can be most successfully attacked. Investigations into the food requirements have revealed that in addition to sugars the flies are attracted to materials which result from the breakdown of the proteins occurring in yeast, soya bean meal, etc. (Steiner : 1952.)

These hydrolysed proteins are used to attract the flies in the recently developed baits. The flies are unable to live longer than about four days without food and consequently if baiting is regularly carried out by all growers it would be possible to poison off many flies before they reach the egg laying stage.

The flies seldom stray far from the protecting foliage of fruit trees, although marked flies have been recovered up to two miles downwind from the release site. Local trapping experiments have revealed that movement from an orchard into host free areas is extremely limited. When suitable hosts are available a puncture is made in the skin of the ripe or ripening fruit by the female fly and six to eight eggs are deposited in the cavity made.

The Eggs.

The eggs, which measure approximately 1/25th inch in length and are a creamy white colour, hatch in summer in from two to four days. In winter, however, the time required may be as long as 20 days.

The Larvae.

The tiny maggots, upon hatching, immediately commence feeding and burrowing into the fruit. This activity causes the tissue to break down, soft spots to form and in some instances the complete decomposition of the fruit. The maggot when fully grown is about 1/3rd of an inch in length and creamy white in colour. In fact, it resembles very much in general appearance a house fly maggot or an under-sized blowfly maggot.

The time spent in the fruit will vary according to the weather conditions and the type of fruit, but the period in summer is about 14 days and in winter sometimes as long as 45 days. One interesting feature about the fruit fly maggot is its ability to jump. When placed on a dry surface it can, by a sudden muscular action, skip to a distance of a foot or more. This is not however a characteristic of the fruit fly maggot alone for various fly larvae, including "cheese jumpers" and the maggots of the tomato fly, possess this ability.

When fully developed, the maggot leaves the fruit, drops to the ground, if the fruit has not already fallen, and burrows into the soil.

The Pupae.

As soon as it burrows into the ground the maggot changes into a rounded barrel-shaped pupa looking not unlike a rather dark swollen grain of wheat. The pupal or resting stage varies from 12 to 50 days according to the time of year after which the fully developed fly emerges and forces it way up to the surface of the ground.

LIFE SPAN OF FRUIT FLY STAGES IN WESTERN AUSTRALIA

	Adult Fly	Egg	Larva	Pupa
Summer	28-112 days	2-4 days	14-16 days	12-14 days
Winter	17-112 days	10-20 days	25-45 days	25-50 days

Fig. 3.—An orange showing numerous fruit fly punctures in the skin

FRUITS ATTACKED

Well over 100 fruits, nuts and vegetables have been recorded as hosts for the fly in different parts of the world. Many of these records have, however, been secured under artificial conditions and certain hosts are definitely more susceptible to attack than others.

In Western Australia, the fly has been found attacking peaches, figs, apricots, pears, all citrus fruits, nectarines, apples, grapes, plums, persimmons, quinces, loquats, plantains, passion fruit, bananas, mulberries, olives, walnuts, tomatoes and the sapodilla. Such ornamentals as the guava, feijoa, pomegranate, clerodendron, lillypilly, chilli, rose, Irish strawberry, Barbados gooseberry, prickly pear, Osage orange and Natal plum, are also known hosts, and to complete the list must be added the following weeds: African box thorn, apple of Sodom, and black-berried nightshade.

An examination of this list will show that not a single native plant is included. The importance of this cannot be too fully emphasised, for it means that with the exception of relatively unimportant weeds, all the hosts of the fruit fly in Western Australia are cultivated plants. This simplifies, or should simplify, the problem of control very considerably. It means that if all growers were fully alive to their responsibilities the fruit fly menace could be, if not eradicated, so reduced as to be of little importance. In countries where native fruits harbour the pest the task is very different. There every care may be taken in the orchard only to be nullified by an invasion from bush or jungle, but in Western Australia a man can only blame either himself or his neighbour (of course it is usually the latter) for the presence of fruit fly in his orchard.

RELATIVE IMPORTANCE OF DIFFERENT HOST FRUITS

All host plants are, of course, not equally attractive to the fly or suitable for its development. In the passion fruit, for instance, fully-developed maggots have never been found in this State, although damage is caused by the disfiguring wart-like growths which arise on the skin following egg-laying. Maggots have been found working in pomegranates but no flies have been reared from such fruits Although not normally regarded as a host when picked under commercial conditions, bananas have been found infested with fruit fly and adult flies have been bred from fruit infested in the field. Tomatoes, olives and walnuts were all found infested with fruit fly for the first time in Western Australia in 1955, (Jenkins 1955). Development in lemons only occurs in very ripe fruit and normally then only when the skin has been split or broken. Many plums and grapes are apparently too watery to

form suitable homes for the maggots. Peaches, apricots, pears and figs, on the other hand, are notorious breeders of the fly.

Although citrus growers suffer comparatively little loss from fruit fly, citrus are amongst the most important hosts of the pest. The reason for this is that when the summer soft fruits are finished the fly is able to carry over the winter in the citrus orchards. Grape-fruits are amongst the most susceptible varieties to infestation, but it is an interesting fact that only a low percentage of the eggs laid in citrus develop successfully. It is believed that the oil in the rind seals the egg cavity, or in some way interferes with normal hatching.

The attractiveness of oranges to the fly is amply exemplified by the number of punctures which may be seen on fruits in any infested orchards. These punctures are readily observed, for a discoloration of the surrounding skin results, and such marks are popularly known as "stings."

Another host plant which must receive attention is the loquat. This fruit is very important because it serves as a link between the winter citrus and the early stone fruits, and the bigger build up of population there is in the loquats, the earlier will losses occur in apricots and other soft fruits.

POWERS OF REPRODUCTION

As an illustration of the great reproductive powers of this fruit pest, the following figures are illuminating. From one pair of flies laying on September 1, the possible progeny by the middle of January, a period of 4½ months, would amount to 6,750,000 flies. Such a calculation is based upon each female laying 300 eggs, 150 of which would produce female flies, and so on. Of course, this hypothetical reproduction never takes place in actual practice, but the potentialities are sufficient to make it clear to everyone that the pest is not one to be trifled with.

ECONOMIC IMPORTANCE

The financial loss to fruit growers in this State generally caused by the fruit fly each year is difficult to calculate; that it is considerable none will deny. In addition to the actual value of the fruit lost and the expense and labour of constantly fighting the pest, the indirect loss caused by the fact that the cultivation of certain

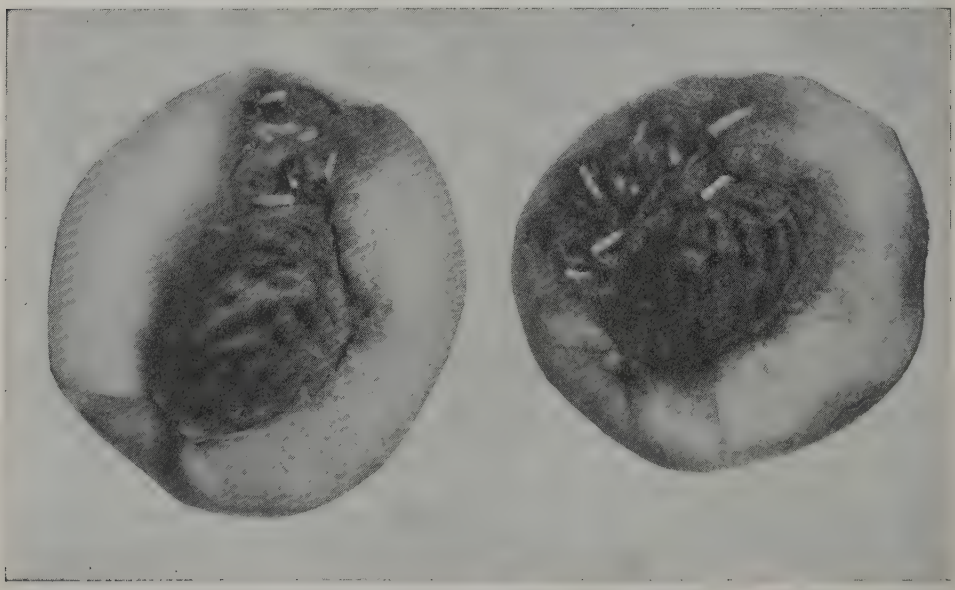

Fig. 4.—Peaches showing typical fruit fly damage

profitable crops is prevented or limited must be borne in mind. When it is remembered that the average value of the fruit industry to Western Australia is several million pounds per annum, the necessity for doing everything possible to control the pest will be evident. Not only must it be checked in areas where it is now present, but its spread to clean districts must be prevented.

CONTROL MEASURES

REGULATIONS gazetted under the Plant Diseases Act make it compulsory to take action against fruit fly. The first thing to be realised is that for really satisfactory results concerted action is necessary. A few careless individuals in a district can do much to nullify the work of their neighbours and perhaps jeopardise their livelihood. Although foliage baiting and orchard hygiene are still the mainstay of the control programme, cover sprays and the use of a fruit fumigant have their place in the overall attack against this pest.

TRAPPING

For many years trapping by means of lures such as pollard and borax, "Clensel" and "Beeco" solutions in glass jars and tins was widely advocated, and when intensively carried out was quite effective. In recent years research has been intensified in this field, especially by American workers, who have found that oil extracted from Angelica seed and similar synthesised materials are very attractive to male flies. (Steiner *et al* 1957.)

These materials attract more flies than any of the general lures but the consequent reduction in male population cannot be expected to have a very marked effect on the total infestation. Their main use, therefore is as indicators. Some of the protein hydrolysates, which are used as foliage baits, when mixed with water and ammonium chloride in traps attract fruit flies of both sexes as well as a range of other insects.

BAITING

The replacement of traps by foliage baits was first recommended in this State in 1936 (Newman and Jenkins 1936) their advantage being increased efficiency and ease of application. Although such insecticides as DDT, BHC Parathion and HETP ("Hexone") were all tested as they became available, they showed no improvement on sodium fluosilicate and no real advance in baiting methods was made until the development of mixtures containing malathion plus hydrolysed yeast and malathion plus sugar.

Bait Formulae Recommended.

	Orchard	Backyard Garden
1.		
*Malathion 50% emulsion (or its equivalent)	4 oz.	1 teaspoonful
Yeast hydrolysate	2 oz.	½ teaspoonful
Water	4 galls.	1 pint
This formula should not be stored after mixing.		
2.		
*Malathion 50% emulsion (or its equivalent)	4 oz.	1 teaspoonful
Sugar	2½ lb.	1½ oz.
Water	4 galls.	1 pint
This formula should not be stored after mixing.		
3.		
Sodium fluosilicate	1 oz.	
Sugar	2½ lb.	
Water	4 galls.	
For backyard gardens a stock solution can be made using :—		
Sodium fluosilicate		1 teaspoonful
Water		1 pint
For use thoroughly shake the mixture and add six tablespoonsful (3 oz.) of the stock and 3 tablespoonsful of sugar to one pint of water.		

* Growers using wettable powder preparations of Malathion should avoid the fruit as disfiguring residues may occur.

PROPRIETARY MIXTURES

A number of yeast and other protein materials in paste, powder and liquid form suitable for use in malathion baits have recently appeared on the market. Certain proprietary mixtures of sodium fluosilicate and sugar also comply with Departmental recommendations.

How to Apply Bait

In a large orchard or vineyard the use of some type of spray pump fitted with a coarse nozzle will usually be found the most convenient way of applying the spray. Where such expensive equipment is not warranted, however, the bait can be splashed on the foliage with a whitewash brush or applied through a container with a perforated lid such as a shaker-topped bottle.

Fig. 5.—Foliage bait spraying and picking up fallen fruit

When to Apply Bait.

The maximum period between treatments should be six days, but, of course, if heavy rain washes the bait off before this time has elapsed, a second treatment should be given. As the fruit fly frequently attacks fruit before it is ripe baiting should be commenced at least six weeks before the crop is ready to pick and continued right through the season until a couple of weeks after the trees have been stripped, just to make sure that any straggling flies are not allowed to escape.

Particular attention should be paid to the baiting of citrus during fine spells in winter. Orange and lemon trees provide the flies with food and shelter and play an important part in carrying over the pest from season to season.

Warning

In mixing and applying any of the formulae the quantities stated should be rigidly adhered to, thus reducing the chance of any possible injury to the foliage or harmful deposits of poison on the fruit. Some people apply a complete cover spray to their trees when baiting in the belief that they are fulfilling requirements. The object should be to have a quantity of bait here and there on two or more sides of the tree, avoiding the fruit as much as possible. Wandering flies will then have a good opportunity of feeding.

COVER SPRAYS

Many materials have been tested as complete cover sprays to kill the fruit fly on contact. Insecticides such as parathion, malathion and Hexone will give a rapid knock-down to flies present at or very soon after the application of the spray. However, the comparatively short life of these insecticides, particularly when not used in conjunction with a lure, renders their value somewhat limited.

The high toxicity of parathion is another serious disadvantage to its use, but when other pests such as citrus white fly or aphis are present in addition to fruit fly an application of malathion would be useful against all three.

DDT has been used against various fruit flies in other parts of the world, but trials locally have given little success.

Dieldrin is another insecticide which has been used as a cover spray against fruit fly. However the danger of contaminating ripening fruit and the increase in mite populations which may occur make the general use of dieldrin undesirable.

Dipterex.

The action of Dipterex offers a new and interesting approach to fruit fly control, for besides being toxic to the flies on contact it penetrates the fruit and kills both eggs and maggots. By applying the material before the strikes have developed most fruit can be harvested in a sound condition even though the puncture marks are still apparent.

Recommendations.

Stone Fruit.—I fluid ounce in 6 gallons of water (1 pint in 120 gallons).

Pears.—1 fluid ounce in 3 gallons of water (1 pint in 60 gallons).

Note.—1 pint of Dipterex liquid concentrate is equivalent to 1 lb. of Dipterex soluble powder.

It is advisable to double the concentration for the first spray particularly if any larval development has occurred. Spraying should be repeated at no more than 10 day intervals. Results are often proportional to the completeness of cover so a thorough application is essential and the addition of a wetting agent for very smooth or waxy-skinned fruit is advised. Local experience has shown that better control is normally achieved on stone fruit than on pears. This spray is not recommended for citrus.

ORCHARD SANITATION AND DISPOSAL OF INFESTED FRUIT

Although insecticidal methods are important factors in fruit fly control they can only hope to be really effective when carried out in conjunction with strict orchard hygiene.

As the fruit becomes mature, it should be picked. Fruit left on the tree is a potential breeding ground for the pest which will develop rapidly in the ripe material. Infested fruit should never be allowed to lie on the ground, and should be disposed of by boiling, burning or soaking in water and kerosene. Burying is not recommended and when the life history of the pest is recalled the reason will be clear. The maggot naturally burrows into the soil to pupate, so that by burying maggoty fruit the flies' normal development is only being assisted. Certainly, if the fruit is buried deeply enough no insects can emerge, but when it is remembered

Fig. 6.—Infested fruit being tipped into a drum of water and kerosene

that fruit flies have successfully pushed their way through four feet of dry sand the weakness of this method is obvious. It has been found that infested fruit placed in a pit and liberally treated with BHC dust before filling in will prevent fruit fly development (Ryan 1950). This technique may be of value where disposal of large quantities of infested fruit is necessary and where other means of disposal would be too difficult.

In order to simplify the work of sanitation, growers, and this especially applies to back yard growers, are advised not to let their trees attain such proportions that the fruit cannot be easily reached. Special attention should be paid to fig trees and loquats for often these are neglected and allowed to carry far more fruit than can possibly be used. Such trees should be cut back to a height of say 10 feet, so that they can be baited easily and so that the fruit can be conveniently picked. When allowed to grow unchecked they become a menace to neighbours and perhaps to the owner when the Fruit Fly Inspector calls.

GROUND TREATMENT

Dusting or spraying the soil surface under infested trees with insecticides such as dieldrin and BHC has been used on a number of occasions to assist in control measures. Although these materials prevent emergence of many flies when applied in large enough quantities they do not give sufficiently reliable results to warrant the time and expense of application under normal conditions.

FUMIGATION

There are two main applications for the fumigation of fruit. Firstly as a quarantine measure, fumigated fruit may be passed for movement into fly-free areas. Secondly as a further control measure enabling the grower to market fruit with an assurance that there will be no fruit fly development. When used for quarantine purposes strict compliance with the instructions set out below is necessary.

1. **Material:** Ethylene dibromide (EDB) concentrated. HANDLE WITH CARE (see instruction 12).

2. **Quantity:** Citrus fruit 1 lb. (7½ fluid oz.) per 1,000 cubic feet, other fruit ¾ lb. (5½ fluid oz.) per 1,000 cubic feet. (The 1 lb. dose for citrus will not harm other fruit.)

3. **Exposure Time:** Two hours, excluding evaporation time. (See instruction 9.)

4. **Temperature in Chamber:** Not less than 70° F.

5. **Load:** Volume of fruit not to exceed 35 per cent. of total space, i.e. 350 three-quarter bushel cases per 1,000 cubic feet.

6. **Stacking:** Cases to be stacked to allow adequate air circulation. Optimum conditions are a compact stack with horizontal battens between each layer in line with direction of circulation.

7. **Packing:** Fruit to be in standard cases and not wrapped.

8. **Chamber:** Any room, tent or similar situation which can be effectively sealed.

9. **Evaporation:** Care should be taken that the liquid EDB does not come in contact with the fruit. The fumigant should be evaporated in a flat-bottomed dish on an electric hot plate or similar heating apparatus. The fumigant should not be deeper than 1 inch in the container which should have sides from 2 to 4 inches above the surface of liquid. Evaporation time should be between 10 and 30 minutes and is additional to the 2 hour exposure time. The longer evaporation time may be an advantage in securing more even dispersion of the fumigant.

10. **Position of Hot Plate:** The evaporation should be carried out in an elevated position and in such a manner that the circulation of air will provide rapid dispersion of the heavy gas. The hot plate should not be in such a position that a large proportion of the vapour will come in contact with a limited number of cases. Where the hot plate is used on the top of a stack of fruit this danger will be reduced by placing the plate in the centre of an iron tray or asbestos sheet 2 feet square.

11. **Circulation:** A fan or other device is necessary to provide adequate circulation.

12. **Health Hazard:** Although EDB is a relatively non volatile liquid at normal temperatures, care must be taken in handling this material. The gas is highly toxic to humans and the liquid is a severe skin irritant. After fumigation the chamber should be evacuated by means of a suitably placed exhaust fan. The interior surface of the chamber may become saturated with EDB and if so it will give off toxic fumes after apparent exhaustion. This could be a hazard if the chamber were exhausted, then closed and entered again some time later without further exhaustion. The exhaust should therefore be in operation before entering the fumigation chamber, and also while anyone is in it.

PARASITES

Since 1904 seven attempts have been made to establish various fruit fly parasites in Western Australia. The first six of these met with complete failure, for although some of the parasites were carried through several generations in the laboratory, no field recoveries were made (Jenkins 1948). The most recent attempt involving the introduction of four different parasitic wasps from Hawaii, shows slightly more promise as a number of wasps have been reared from fruit collected in the field. The egg parasites offer the greatest chance of success, although at present there seems little likelihood of biological control methods superceding more orthodox treatments.

LEGISLATION

To aid in the control of fruit fly, it has been found necessary to introduce certain regulations including compulsory baiting in certain areas and the restriction of movement of fruit within the State.

Registration.

All fruit trees must be registered with the Department of Agriculture and a registration fee paid. The details supplied enable inspectors to check on the most susceptible types of fruit at various seasons of the year and to advise on control measures where these are not being carried out efficiently.

Compulsory Baiting.

Where fruit fly occurs it is compulsory to carry out control measures including the application of one of the baits recom-

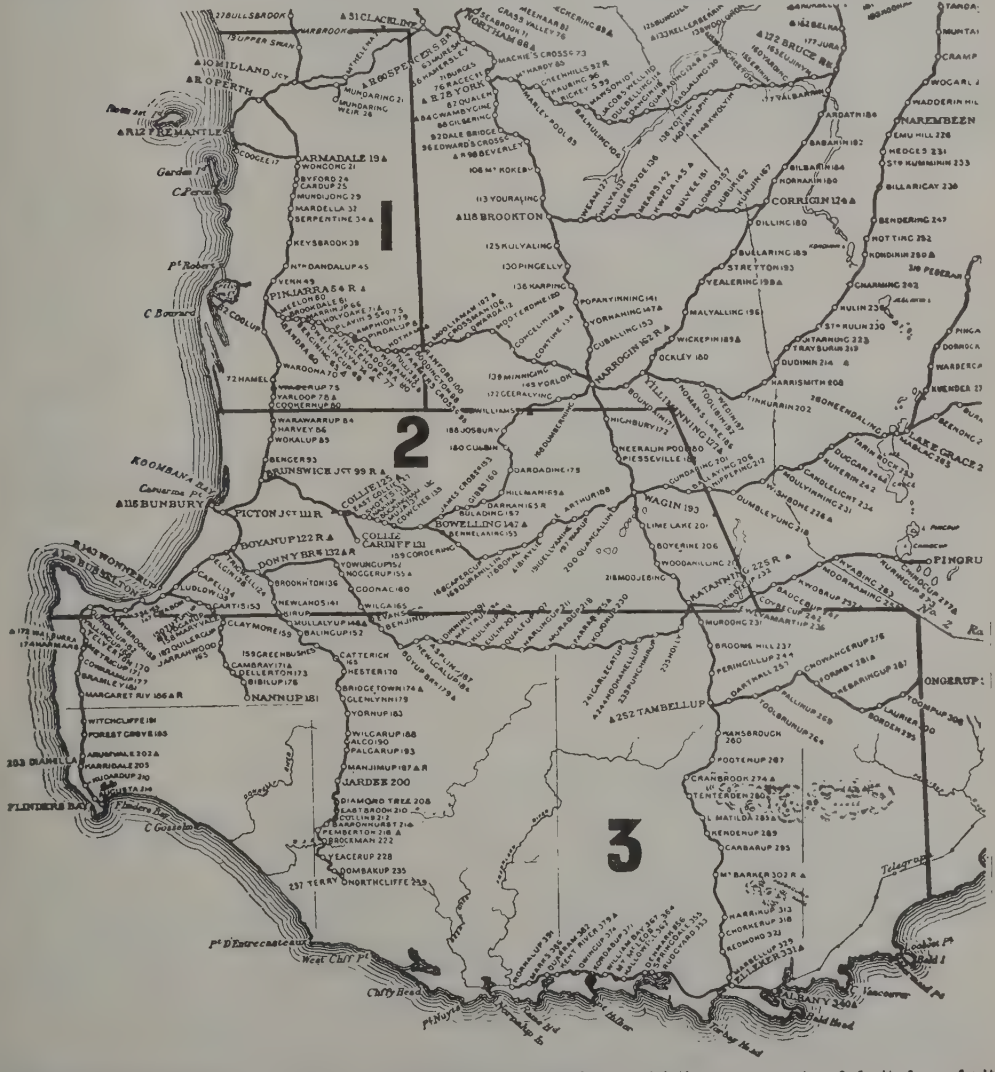

Fig. 7.—Map showing Areas 1, 2 and 3 mentioned in the regulations restricting movements of fruit from fruit fly infested areas

mended in this article and the regular gathering of fallen fruit.

In districts where more than 60 per cent. of the growers voting in a poll agree, the baiting may be carried out on a community basis.

Movement of Fruit.

The main fruit growing districts of the State have been divided into three areas. Area 1, which includes the Metropolitan Area, the coastal plain as far south as Cookernup and the associated Hills districts, is considered to be regularly infested and fruit movement from this area is restricted. Area No. 3 which embraces that part of the State south of Katanning and Kirup is considered normally to be free of fruit fly and movement of fruit into this area is restricted. Area No. 2, which is the zone between Areas 1 and 3, has certain restrictions limiting both the inward and outward movement of fruit.

Free movement of fruit throughout the State is allowed after it has been fumigated under the supervision of an inspector and according to the instructions set out in the appropriate section of this article.

Further details concerning these Regulations can be obtained by referring to the relevant portions of the Plant Diseases Act, copies of which are available on application from the Department of Agriculture.

SUMMARY OF CONTROL MEASURES

(1) Prune trees to a manageable size.
(2) Bait regularly with an approved foliage bait.
(3) Spray with Dipterex if necessary.
(4) Pick fruit as it ripens.
(5) Destroy properly all infested fruit.

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Fig. 1.—Harvesting operations in progress at Bridgetown

PRODUCING GOOD QUALITY SUBTERRANEAN CLOVER SEED

By B. J. QUINLIVAN, B.A., B.Sc. (Agric.), Adviser, Seed Certification and Weeds Branch

HARVESTING of subterranean clover seed for sale has been carried out for many years now, and unless the unexpected happens it will continue to be a valuable secondary crop for farmers in the medium and higher rainfall districts. There have always been a number of problems associated with the production of good quality seed, but as harvesting and grading techniques have improved many of these have disappeared. There are a few which still remain.

Not all seed of course is certified, but the minimum standards required for certified seed can be taken as a basis of good quality. Certified seed must meet the following requirements:—

(1) At least 95 per cent. true to type as regards strain.
(2) Free from all serious weed seeds.
(3) A pure seed content of at least 98 per cent.
(4) A minimum germination of 80 per cent.

With the modern grading machinery at our disposal there are no longer any technical problems associated with the production of seed with a satisfactory purity and free from weed seeds, but there are still difficulties in the way of producing seed with a satisfactory germination. Over the last few years it has not been uncommon for up to 10 per cent. of all seed submitted for certification to be rejected because the germination was below the minimum requirement. With over 100 tons of seed involved, this rejection caused a considerable financial loss. Some of this seed eventually was passed after further treatment, but in many instances there was no possible way of bringing the seed up to standard.

When a germination test is undertaken in a laboratory the seeds or seedlings present at the conclusion of the test are classified as germinated seedlings, hard seeds, dead seeds, or broken seedlings. A low germination figure therefore results when a high proportion of the seeds or seedlings falls into the latter three categories.

In some instances the producer has little or no control over the factors which cause an excessive proportion of dead or broken seedlings, but in other instances a slight adjustment in technique could make all the difference.

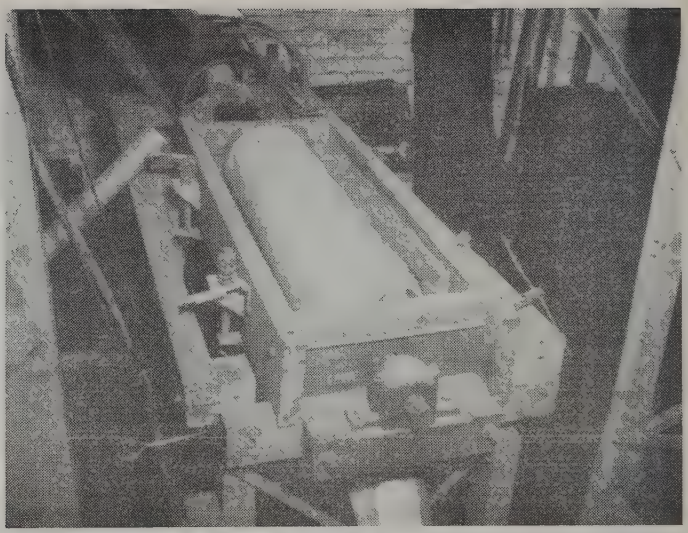


Fig. 2—A decoating machine with the top removed showing wire mesh roller and fibre mat

HARD SEEDS

A hard seed is one which is impermeable to water and is not capable of immediate germination. It may remain ungerminated for many years.

All legumes have hard seeds, and under pasture conditions this is a desirable asset, in that it ensures survival of the species from year to year irrespective of seasonal variabilities. However, in the year of establishment of a new pasture a high hard seed content is not desirable. Subterranean clover has a natural hard seed content which varies between 60 per cent. and 80 per cent. The extent to which this hard seed is converted into seed capable of immediate germination depends entirely on the efficiency of the "decoating" or scarification technique.

The types of decoater in use at present are many and varied, but unfortunately not all of them are efficient. Some of the machines recently installed in grading sheds decoat the seed effectively but the scarification is not sufficient to convert the hard seeds into germinating seeds.

One of the most satisfactory machines is the older type, which consists of a wire mesh roller revolving at a speed of approximately 400 r.p.m. within a concave lined with a fibre mat. A clearance of approximately one inch is left between the roller and the fibre mat. This type of machine will produce a high germinating sample provided the seed is not forced through too quickly. An output of eight to ten bags an hour is all that it can effectively handle. The comparatively slow output is one of the reasons why this type of machine has been discarded by some seed-grading firms and replaced with machines capable of higher outputs.

If these newer machines cannot be modified to improve their scarification it will be necessary for seed-grading operators to give serious thought to the reintroduction of the older, more satisfactory types.

DEAD SEEDS

Legume crops or pastures as a group normally have a very low dead seed content and in this respect they differ from some of our native flora—the seed of which, under optimum conditions, will give only a very low germination. If the dead seed content of any line of subterranean clover seed is in excess of 10 per cent. or 15 per cent., it is obvious that something went astray prior to, or during, harvesting operations.

Dead seeds can be caused by a number of factors, but by far the most important is fire damage. Of the strains which are at present harvested in quantity, only Dwalganup is immune to damage by fire, the reason being of course that it buries its burrs below the ground surface. Very little, if any, preharvest burning is carried out

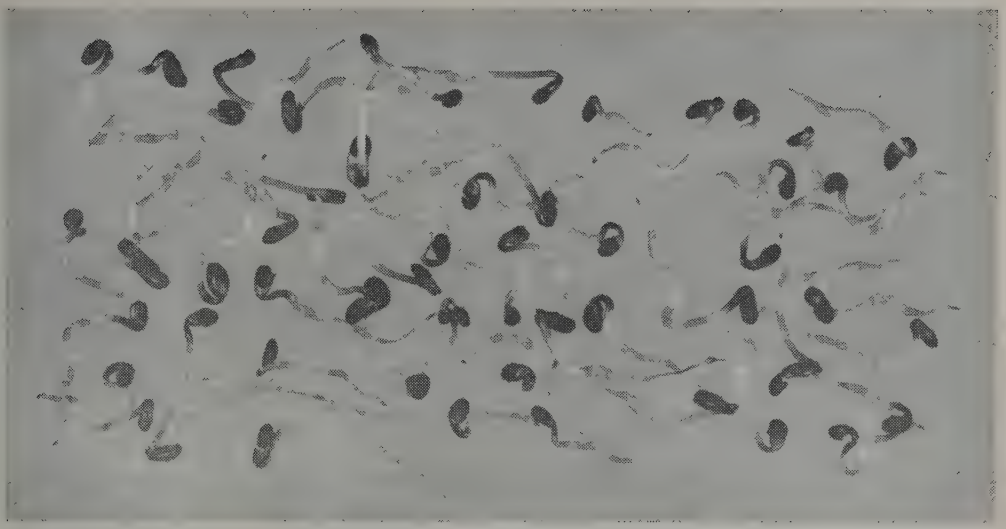


Fig. 3—A seed sample with good germination

now with the later-maturing strains such as Mt. Barker or Tallarook but burning is still a common preharvest practice with the Yarloop strain.

The Yarloop strain is an intermediate type, in that it sometimes buries its burr and at other times does not. The final position of the burr depends largely on the height of the top growth, the soil type and the age of the pasture. Burning the top growth prior to harvesting speeds up the actual harvesting operations considerably, and in these days of relatively low prices is frequently an essential technique if seed is to be produced cheaply.

There are no definite rules which can be specified as to how a paddock should be burnt without damaging the seed. The

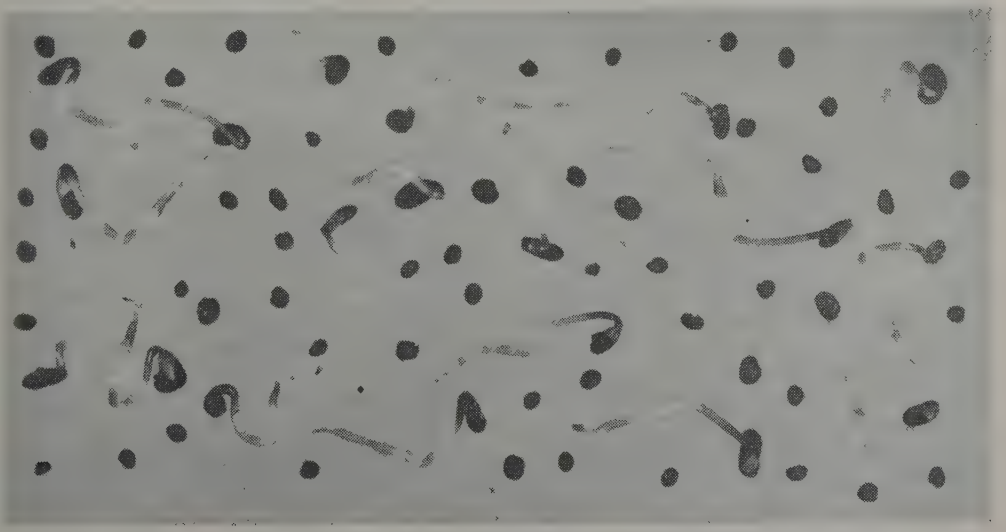


Fig. 4—This sample was not scarified sufficiently and carried a high proportion of hard seeds

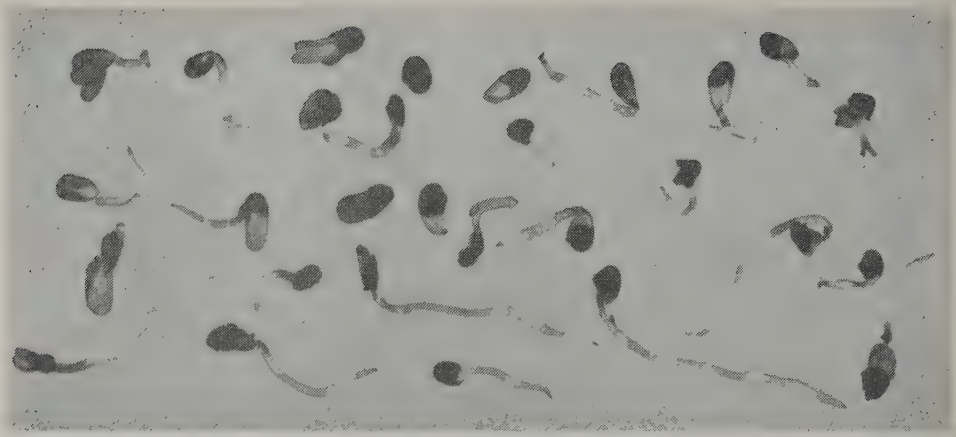


Fig. 5—This sample contained a very high proportion of broken seedlings. Note the extreme malformation of many of the seedlings

only points that can be made if burning is contemplated are, that the producer should examine carefully the amount of top growth and the position in which the burr has been set. The amount of top growth is a very important factor; if it is excessive, as much as possible should be removed before burning by stocking the paddock, or by some other means. If a high proportion of the burr has been set above ground or on the soil surface, burning the paddock should be avoided. Harvesting seed from the paddock will be more difficult, but at least the seed will have a high enough germination to be saleable.

BROKEN SEEDLINGS

A broken seedling is one which is not capable of developing into a normal plant. The seeds from which they originate more often than not have been damaged prior to, or during harvesting. The seedlings which develop have malformed or broken radicles or cotyledons and are incapable of development beyond the seedling stage. The two commonest causes of this fault are rain damage prior to harvesting, and excessive mechanical injury during threshing or grading operations.

Rain Damage—If rain falls on a paddock prior to harvesting, the germination process will commence in some seeds. If hot dry weather follows the rain, the germination process will cease and the seed will dry off. The majority of these seeds are incapable of normal development later in the year—at the best they can produce only a broken malformed seedling. The extent of the damage in any particular paddock depends on the quantity and duration of the rain, the actual date on which it falls, and the strain of sub-clover being grown.

Subterranean clover has a natural ability to survive unseasonal rains. It does this in two ways, firstly, by producing a high proportion of hard seeds which are impermeable to water and will not germinate for several years, and secondly, by its tendency to require a time interval of some six to eight weeks for full seed maturity after the plants dry off in late spring or early summer.

The proportion of hard seeds set varies with the strain and the seasonal conditions. Generally the earlier-maturing strains such as Dwalganup set a much higher proportion of hard seeds than do the later-maturing strains such as Mt. Barker. The extended seed maturity period is a factor common in many plants. When the plants set seed and dry off in late November or early December, the seeds formed are not capable of immediate germination even though they may be fully permeable to water. Full ripening and maturity does not take place with most seeds until late January or early February, and as such, unseasonal rains

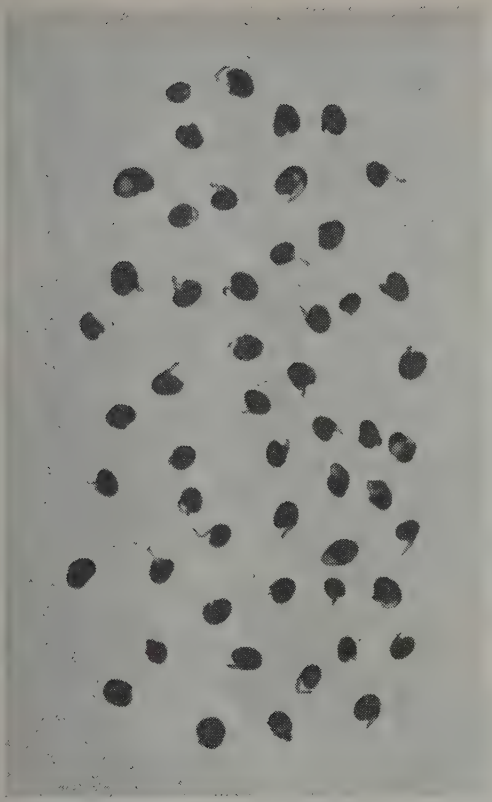


Fig. 6—Rain damaged seed. The damage is not so obvious after the seed has been graded as the decoating process removes most of the protruding radicles

in the early summer will not do as much damage as rains which fall in the late summer or early autumn.

There is nothing any producer can do to avoid rain damage, but if harvesting is contemplated late in the season and there are reasonable grounds for suspecting rain damage, it would be advisable to collect a sample of the burr from the paddock and forward it to the seed testing laboratory. A test could be carried out which would give an accurate indication of the likely germination of the final product.

Faulty Grading or Threshing—If the threshing or scarification machinery is not correctly adjusted, it is quite common for much of the graded seed to be partially skinned or chipped. This damage to the seed coat and the embryo or endosperm not only detracts from the appearance of

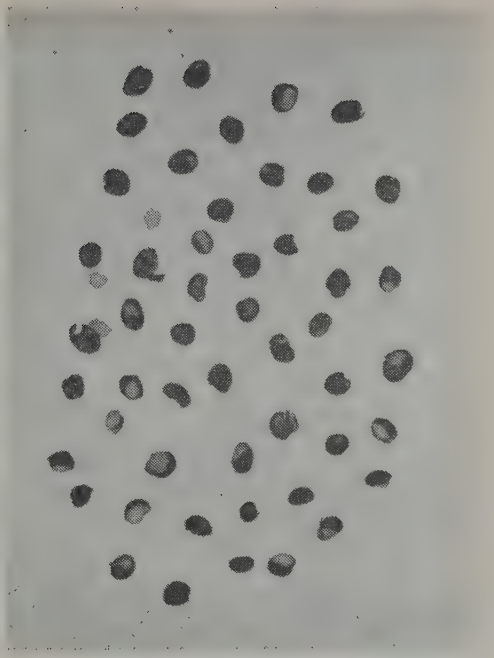


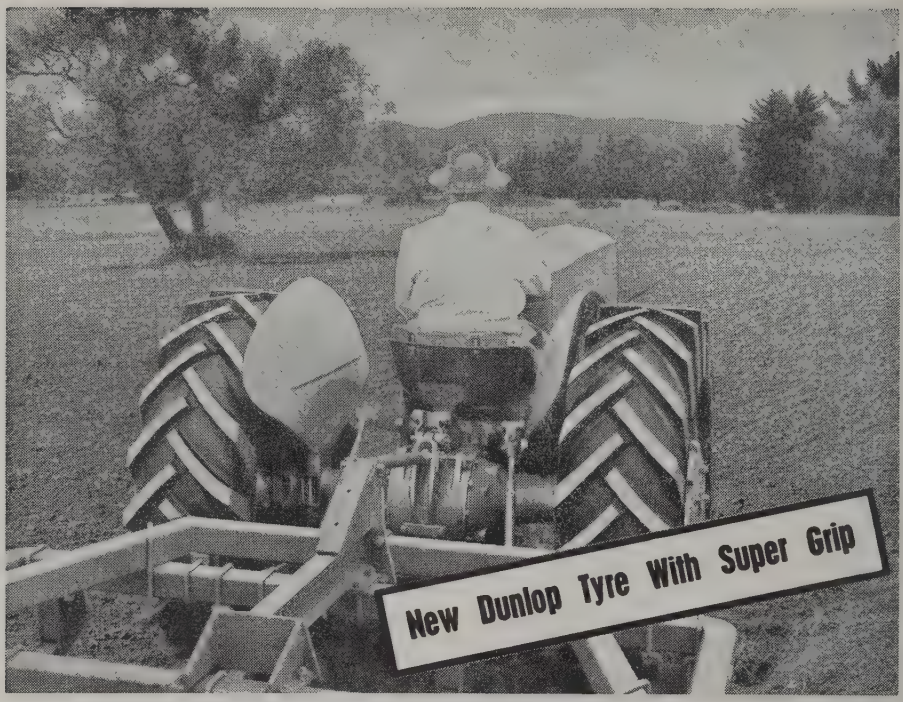
Fig. 7—Badly chipped and skinned seed. The result of faulty threshing or grading

the graded seed but may also cause a considerable drop in germination. Many of the seedlings produced have badly damaged cotyledons or radicles and can only be classed as broken seedlings.

Faults such as these are easily rectified by the correct adjustment of the harvesting or grading machinery.

GENERAL

The relatively low prices on offer these days for subterranean clover seed makes a high level of production efficiency essential. However, if our present markets for seed are to be maintained or expanded, increased production efficiency should not be achieved at the expense of seed quality.



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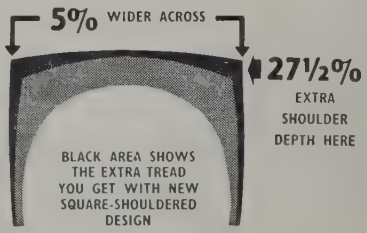

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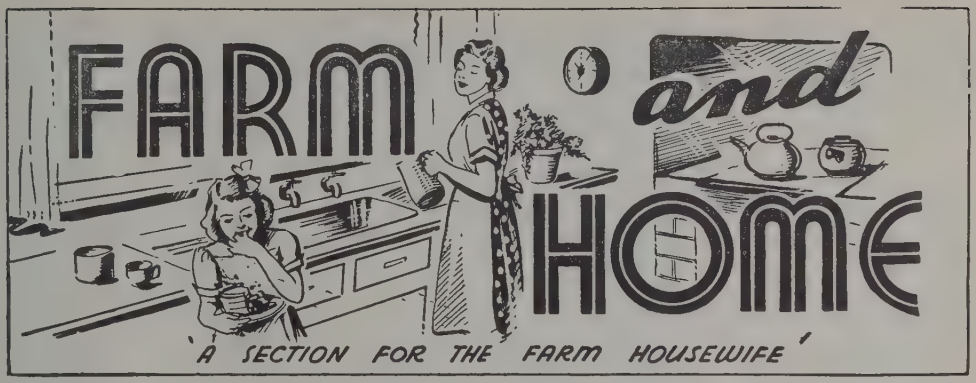

A Plastic Shower Cap

By HELEN M. GLOSTER.

I MET a friend the other day who said, "Do write something we can make up for bazaars." This shower cap is very easily made and should make a popular selling line on a fancy stall at a bazaar, for most women dislike getting their hair wet under the shower.

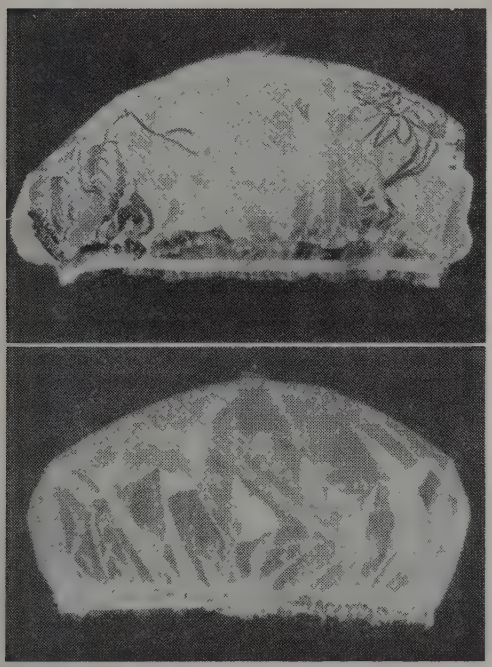

Fig. 1.—Shower caps in figured and plain material

All you will require is a 15-inch square of plastic material and 21½ in. of narrow white elastic.

Plastic may be coloured, opaque or patterned. For travelling, the thin transparent clear plastic is quite satisfactory and takes up a minimum of space when packing.

Method.

1. Cut a circle from the plastic (7½ in. radius).

2. Machine the elastic to the plastic near the edge, stretching the elastic on to the plastic as you proceed.

Elastic must be stretched sufficiently to go entirely around the cap.

Do a second row of machining.

N.B.—It will be necessary to place a sheet of paper between the plastic and the machine while sewing to prevent puckering. Tear paper away after machining is finished.

If there is any difficulty removing the paper, soften it in cold water. A *soft* nail brush will then remove paper.

Plastic food covers.

Plastic covers to fit milk jugs, wide-necked bottles and small basins may be made in the same way, using 12 in., 8 in. and 6 in. circles.

CURRY SAUCE

This sauce is delicious served with casseroled meat or poultry. It is also very tasty with a grill.

Ingredients.

1 pint of stock or vegetable water.
1 tablespoonful flour.
Level tablespoonful curry powder.
½ lb. tomatoes.
1 medium sized onion.
1 teaspoonful soya sauce.
Level tablespoonful butter.
Salt to taste (if required).

Method.

1. Fry onion in butter until a golden brown.
2. Add tomatoes and stock and stew until vegetables are soft.
3. Blend flour and curry powder with a little cold water, then add to the sauce.
4. Bring to the boil, stirring all the time. Boil for 5 minutes.
5. Add soya sauce and seasoning to taste.
6. Serve with hot meat and boiled rice.

N.B.—Little or no salt will be required if stock or vegetable water has been salted.

A Cosmetic Cape

By HELEN M. GLOSTER.

EVERY woman and girl knows how powder marks have a habit of appearing around the neck of frocks. This inevitably occurs when one is dressed and ready to go out and resorts to a last minute powdering of the face.

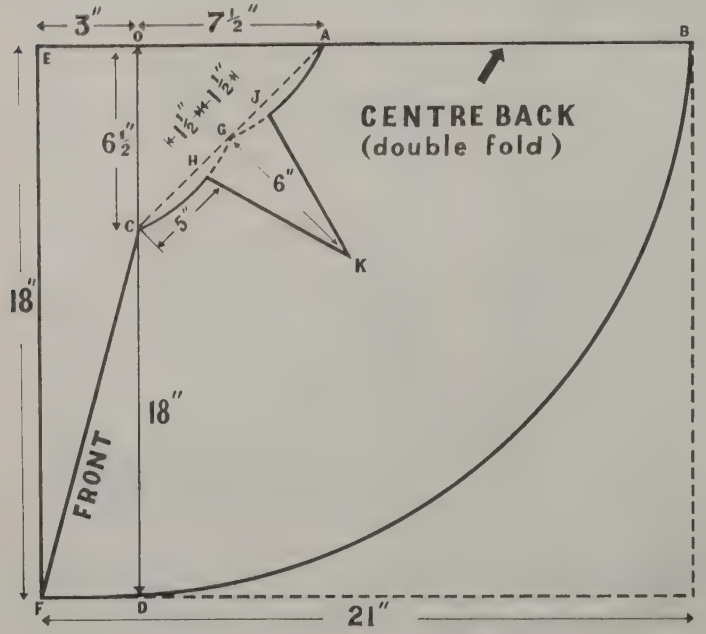

Fig. 2.—Pattern for cosmetic cape

Fig. 3.—The completed cape

This cosmetic cape, made of plastic may be fastened over the frock while the face and hair receive attention.

You will require—

1 yard of plastic material.
1 yard bias tape.
Brown paper to cut pattern.

Method. **The Pattern.**

1. Cut paper measuring 21 in. x 18 in. to form a rectangle.
2. Measure along the 21 in. side O to E 3 in., O to A 7½ in. and O to B 18 in.
3. Drop a line from O to bottom of paper (3 in. from edge all the way).
4. Measure O to C, 6½ in.
5. Rule a line from C to A and measure C to G 5 in.
6. Drop a line from G to K at right angles 6 in.
7. Measure out from G 1½ in. on either side for the dart. Lines H K and J K are joined but shaped off at 5 in.
8. Curves joining C, H, G and A, J, G are marked in. The lower edge of the cape is marked in by working in a radius of 18 in. from point O.

If a compass is not available measure down 18 in. from point O at intervals and join.

9. Continue swinging the compass until point F is reached.
10. Rule a line from C to F.

To Make the Cape.

1. Fold the plastic in two, the length of fold 21 in. This forms centre back.
2. Place pattern on plastic and cut out.
3. Machine in the darts, and tie off cotton ends.

Be sure to place paper between machine and plastic while sewing.

4. Bind the top of cape with bias binding and leave ends for tying.

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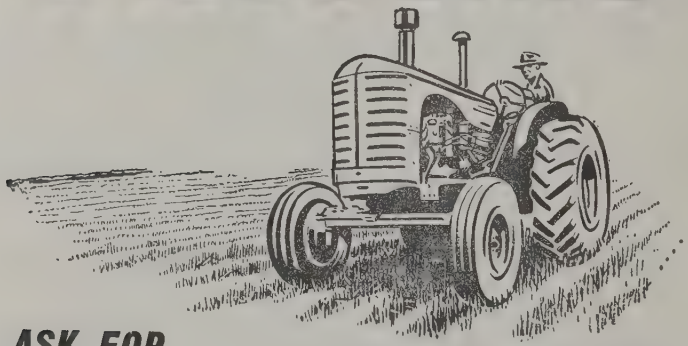

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This lamb has severe footrot infection. On the left it will be seen how the hoof has grown long and been bent under the sole. The right hand photograph shows how the wall of the hoof has separated from the foot so that it is only attached round the coronet

Progress in the Eradication of Footrot

An A.B.C. Country Hour Broadcast by C. R. TOOP, B.V.Sc., Chief Veterinary Surgeon

AT the present time there are only 28 properties under quarantine for footrot in Western Australia and there is reason to expect that the incidence will be further reduced before the end of the current year. It is 10 years now since action was first taken in this State for the control of this disease and some excellent progress has been made in the meantime.

In the initial stages it was only possible to police the markets so as to limit the spread of infection from property to property, and to undertake a very limited amount of eradication work.

Later however, the present methods of control were developed and proved effective and they have since been used to good advantage. Footrot had already been scheduled as a notifiable disease and there was authority under the Stock Diseases Act regulations to quarantine affected properties, to regulate the movement of sheep from these properties to markets, and to require affected sheep found in saleyards to be sold for slaughter. It was only necessary therefore to apply the existing regulations—firmly, but with commonsense and discretion—and there was no need for recourse to special legislation.

QUARANTINE YARDS

It was during this period too that quarantine yards were established at Midland Junction which enabled affected sheep to be sold separately from clean sheep without making contact with them and without passing over the same ground. Provision was also made for the cleansing and disinfection of road and railway trucks used for the delivery of affected sheep to the Quarantine Siding, which ensured that any sheep that were afterwards transported would not be exposed to infection.

CAMPAIGN INTENSIFIED

By 1954 an adequately trained and experienced staff had been recruited and it then became possible to launch a full-scale campaign against the disease. Since that time footrot has been vigorously attacked wherever it has been found to exist, and it has been possible to undertake eradication measures in every known affected flock. In addition, a constant watch has been kept both over markets and individual flocks for the detection of new and undisclosed infections. The methods employed in the eradication of footrot are now so well known and have been re-stated so often that they need only to be mentioned in passing.

They are based upon the knowledge that the infection is carried in the feet of the sheep and that it is unable to persist in the soil for more than about seven days. Thus by removing all sheep which are carrying the infection from a flock and turning those which remain into a paddock which has been spelled for a fortnight, it is possible to eradicate the disease.

SPRING, THE CRITICAL SEASON

Footrot is most active in the spring when the lush pastures and warm, moist conditions are favourable to the rapid spread of the infection. With the advent of summer however, the disease subsides and ceases to spread; many of the cases clear up spontaneously, but a variable proportion—usually not very large—remain as "carriers," and unless removed, will give rise to a fresh outbreak in the following spring. During this period the infection sinks to its lowest ebb and can be most successfully attacked.

Thus, in Western Australia, summer eradication programmes have been regularly organised in all affected districts taking full advantage of the long, dry season which extends over a period of four to six months.

This work has involved the paring and examination of every foot of every sheep in every affected flock followed by the removal of the "carriers" either for slaughter, or for segregation and treatment as a hospital flock, and it has been necessary so as to ensure that no carrier has escaped detection, to repeat this procedure on two, and sometimes three occasions during the course of the summer. Alternatively, whole flocks have been sold for slaughter and replaced by clean sheep after spelling the property for a fortnight, and where it is practicable to adopt this procedure, it provides the surest and simplest method of eradication.

AN ENCOURAGING RECORD

Since the campaign against footrot began, 659 affected flocks have been quarantined and 631 of them have been freed of infection by one or other of these methods and released from quarantine.

In the Bridgetown-Boyup Brook area where the disease was widespread, only six flocks now remain under quarantine out of a total of 190 which were found to be affected, and the corresponding figures for other districts are:—Albany-Mt. Barker, 4 out of 98, Armadale-Harvey, 6 out of 84, Bunbury-Busselton-Donnybrook, 9 out of 90, Narrogin-Williams, nil out of 50, Kojonup-Katanning 2 out of 31 and Perth-Avon Valley-Gingin, 1 out of 55.

The Geraldton, Moora, Kellerberrin and Narrogin districts have been freed of infection and at Geraldton where there were 40 affected flocks and the disease was rife on the Greenough Flats for many years, no case has been seen since 1955.

The numbers of new infections coming under notice have also progressively decreased. There were 93 in 1955, 70 in 1956, 62 in 1957 and only 25 in 1958. Should this downward trend continue and a substantial proportion of the 28 flocks now under quarantine be freed of infection—and there is every reason to believe that this will be the case—the outlook in 1960 could be very encouraging.

GUARDED OPTIMISM

It should not, however, be thought that total eradication is in sight, and while new outbreaks continue to occur even though they may be few and far between and in the main confined to small flocks, it would be dangerous to make any prediction as to the final outcome. Isolated pockets of infection without doubt still exist and until every one of these has been located and accounted for, complete eradication will not be possible.

It should be appreciated also, that footrot is an insidious disease which may be

dormant in the feet for several years only to declare itself and become active and widespread when sheep are brought into an environment which favours the propagation of the infection. It can however, be claimed that the disease has been brought under control and reduced to a level where it is now of little or no economic importance.

AVOIDING RE-INFECTION

Farmers who have experienced an outbreak of footrot and the associated heavy losses, should not need to be reminded of the importance of preventing the reintroduction of the infection into their flocks, or of the precautionary measures which should be observed, but every flockowner in the higher rainfall areas which are liable to footrot would be well advised to take the same precautions.

Replacement sheep should be purchased in the dry inland areas where footrot is not known to occur, and it should be insisted that they were bred in the district and that no introduced or dealers' sheep which might contain "carriers" are included in the consignment. They should be run as a separate flock and kept under observation during the winter and spring months, so that should an outbreak occur, it can be promptly eradicated without involving the rest of the sheep on the property.

Rams should be carefully examined for the presence of foot lesions at the time of purchase and unless required for immediate service they should be held in strict isolation and kept under close observation throughout the flush period of the year. Imported rams are not only required to be certified as free of footrot, but also to have come from properties on which the disease is neither known nor suspected to exist, and while there has been strict compliance with these conditions by the exporting States, the additional precautions of a careful examination of the feet, and a period of isolation are advisable.

Community dips should be avoided and outside sheep should not be allowed to be brought on to the property for dipping, crutching or shearing.

Boundary fences should be maintained in a sheep-proof condition so as to exclude any possibility of the introduction of infection from adjoining properties.

With the restrictions now in force, it is unlikely that sheep will be exposed to infection during transit, but the risk cannot altogther be ignored, and it would be a worthwhile precaution to put all newly purchased sheep through a formalin footbath before releasing them on to the property.

Finally, should any evidence of lameness be observed in the flock, the matter should be promptly reported to the District Stock Inspector. It will most likely have resulted from foot abscess, separated wall or the penetration of the feet by doublegees, but it is important that an early diagnosis should be established. Should footrot be found to be present and the owner is fully co-operative, complete eradication will, in most cases be possible within 12 months.

FARMERS

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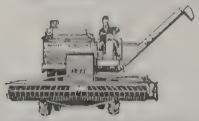
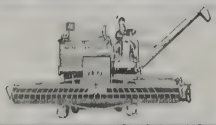
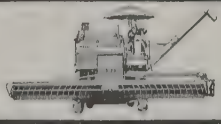


10½ FOOT CUT
UTILITY SIZE



12¼ FOOT CUT
CUSTOM SIZE



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Vitamin A Deficiency in Pigs

By F. C. WILKINSON, B.V.Sc., Veterinary Surgeon

VARYING degrees of Vitamin A deficiency are often seen in pigs which do not have regular access to fresh green feed and do not have a special Vitamin A supplement added to their feed. The deficiency may show itself as failure of the sows to come into season, the birth of dead and malformed piglets, or the birth of weak piglets which die soon after birth. Those Vitamin A deficient piglets which do survive are very susceptible to infectious diseases and often show varying degrees of paralysis. Boars kept on a diet deficient in Vitamin A become infertile.

Unlike such grazing animals as cattle and sheep, pigs are commonly enclosed in pens or yards without access to green feed, the natural source of Vitamin A. Their main foodstuff whether it be grain, boiled garbage, or skim milk is very low in Vitamin A and often insufficient to supply the pigs' requirements.

Green feed has been mentioned above as the main natural source of Vitamin A. Strangely enough there is no Vitamin A in green feed but there is a high percentage of carotene, a chemical compound which when eaten by the pig is absorbed and changed by the tissues of the body into Vitamin A. The Vitamin A so obtained is stored in the liver where it is given up slowly as required by the animal.

The main tissues for which Vitamin A are essential are—

(1) Lining Tissues.—Vitamin A is needed for the normal health, structure and function of all lining tissues of the body but more especially those of the eyes, respiratory system and reproductive tract.

(2) Bone.—Bone growth, especially the control of the shape of the bones in young growing animals, is controlled by Vitamin A. A deficiency of Vitamin A leads to abnormal bone growth of the head and spine with pressure on the brain and spinal cord, which are enclosed in their bony structures.

(3) Eyes.—For night vision a special chemical is required and to produce the chemical, Vitamin A is necessary.

SYMPTOMS OF VITAMIN A DEFICENCY

Adult Pigs.

Rarely are adult pigs visibly affected by a Vitamin A deficiency. Night blindness, which is a common symptom, is very seldom noticed by the owner. In severe cases the sows either fail to come into season or infertility is common. Boars deficient in Vitamin A are also infertile.

Weaners to Baconers.

In this group the commonest symptom seen is paralysis. The paralysis usually begins with incoordination of the gait and swaying of the hindquarters.

This gradually progresses until the hindquarters are completely paralysed. The pig eats normally and growth rate is not greatly affected. In some cases the affected pig will live indefinitely while in other cases increasing pressure on the nervous system leads to nervous fits and death.

New Born Piglets from sows deficient in Vitamin A may be affected as follows:—

1. Piglets born dead.

2. Piglets born alive but very weak. They may lay on their sides, squeal a lot, and show no interest in suckling. The stronger ones show a tendency to burrow and hide under the bedding.

The most obvious symptoms in these piglets in either case are to be seen in the eyes. The eyelids are gummed together with a brown waxlike material and the eyeballs are either bulging, cyst-like or

practically absent. There is often a lot of fluid in the tissues and the abdominal cavity.

3. Piglets may be born normally but with insufficient Vitamin A. These piglets suckle normally and appear to make quick initial growth but are very susceptible to intestinal and respiratory infections. Enteritis with scouring, and pneumonia with coughing are commonly seen.

In some of the piglets in these litters, bone growth around the brain is abnormal and the resulting pressure on the brain causes various nervous symptoms. Before they are very old some of the pigs become paralysed and throw nervous fits. The nervous damage usually becomes more severe until death occurs.

Diagnosis.

When any litters are born dead or weak, a Vitamin A deficiency should be suspected.

Should abnormalities of the eyes be present in the new-born piglets then it is almost certain that Vitamin A is deficient. If litters of young pigs are very susceptible to enteritis and pneumonia, or if paralysis of the hindquarters is often seen in pigs in the piggery then a check should be made to see if there is enough green feed or Vitamin A in the diet. Enteritis, pneumonia and paralysis are not necessarily caused by Vitamin A deficiency.

A common disease causing a similar birth of dead piglets is leptospirosis (red water). In this disease the sow is infected without any obvious symptom being evident until she aborts, which may occur two to four weeks before farrowing is due to take place. If the sow farrows at full time the piglets are born dead or weak. Diagnosis of this disease necessitates the testing of the blood serum of the sow. This of course is a task for the veterinary pathologist in the laboratory.

TREATMENT AND PREVENTION

To prevent Vitamin A deficiency occurring, a good quality fresh green feed should be fed daily or a Vitamin A supplement added to the feed. When feeding green feed, about 2 oz. for every pig each day is all that is required. Hay and silage are unreliable sources of Vitamin A as heat and drying destroy the carotene in these feeds.

Whole milk has fairly large amounts of Vitamin A but skim milk is a very poor source as are most milk products, meatmeal and grain (except maize which is very high in carotene).

Cod liver oil and fish oils contain large amounts of Vitamin A and can be used as supplements but it is easier and cheaper to use one of the commercial synthetic stabilised Vitamin A supplements. These can be obtained in powder or liquid emulsion form for mixing with the feed and details of the quantities to be fed are supplied with the various preparations.

Many commercial preparations contain Vitamin A together with Vitamin D. The Vitamin D would appear to be of no value to pigs kept in Western Australia unless the pigs are kept so that they obtain no sunlight or perhaps for pigs in the very south of Western Australia during the winter period.

When there are obvious symptoms of Vitamin A deficiency a dose of 100,00 international units of the Vitamin A supplement should be given as a drench.

Stop-drop sprays being applied to apple trees at the Stoneville Horticultural Research Station

"STOP-DROP" SPRAYS FOR JONATHAN APPLES

By J. CRIPPS, Horticultural Adviser

THERE is at present no foolproof and entirely satisfactory stop-drop spray for apples. This is unfortunate as the average grower desires simplicity. To date three materials have been included in experimental work undertaken by the Department of Agriculture, namely, NAA (alpha naphthalene acetic acid), 245TA (tri ethanol amine salt of 245 tri chloro phenoxy acetic acid) and 245TP (tri ethanol amine salt of 245 tri chloro phenoxy proprionic acid).

The 245TA did not prove particularly effective in the original experiments and is not completely reliable so that it was omitted from later trials, work being concentrated on 245TP and NAA.

Our findings have been that 245TP has certain distinct advantages. Firstly, it is effective over a longer period (at least 35 days) than is NAA. Secondly its application at 10 parts per million results in a slightly greater reduction in pre-harvest drop than does the application of NAA at the same concentration, but the difference is very slight and of no commercial importance. Thirdly when applied at higher concentrations of about 25 parts per million it advances fruit maturity slightly and increases fruit colour which is an asset when fruit is to be placed on the local market early in the season.

Its most important disadvantage is that its use leads to an increase in the breakdown of fruit after removal from cold storage. Actually in our experiments this was increased from 11 per cent. to 24 per cent. **245TP should not, therefore, be applied to fruit which is to be cold stored or exported.**

NAA on the other hand does not affect the storage life of fruit or lead to deterioration after leaving the cold store.

Its main disadvantage is its short period of effectiveness, but this disadvantage can be overcome by applying one spray at least

a month before harvesting (which would be during the last week in January in the Hills area and possibly a week later in the South-West) followed by a further spray a fortnight later. In one of our experiments two sprays of NAA reduced pre harvest drop to 2.7 per cent. of fruit whereas one spray of 245TA resulted in a drop of 2.2 per cent. of the total crop so that two sprays of NAA are as good as one of 245TP.

Further observations are that a spreader should always be included with all stop-drop sprays even if the manufacturer states that the purchased spray already contains one. Tritan B 1956 was used in our experiments, but any detergent spreader is suitable. Thorough spraying is essential and the trees should be soaked. Thorough spraying involves spraying the tree until a pronounced runoff takes place.

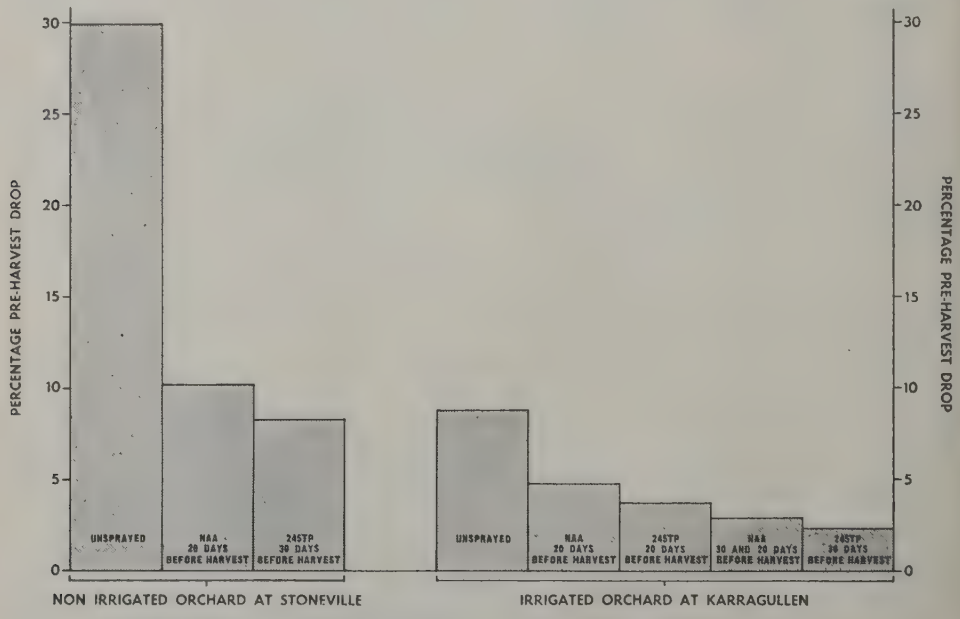
Irrigation reduces fruit drop. In the non-irrigated orchard at Stoneville Research Station 30 per cent. of the fruit on unsprayed trees dropped before it could be harvested. On the other hand trees in a Hills orchard receiving frequent waterings only dropped 8 per cent. of their fruit over the same period.

Hot dry weather also increases pre harvest drop.

The actual drop of fruit commences, with the variety Jonathan, 30 to 35 days before the fruit is ready to harvest for export or cold storage which would be approximately 50 days before it matures on the trees.

In the light of these findings it is suggested that the grower should:—

(1) Ascertain the ingredient of any stop-drop spray purchased and make sure that it is suitable for his purpose.
(2) Add a spreader and spray thoroughly.
(3) Use two sprays of NAA at 10 parts per million at fortnightly intervals if fruit is to be cold stored or exported.
(4) Use 245TP at 25 parts per million 30 days before harvest if all fruit from the sprayed trees is to be placed on the local market early in the season.
(5) Use the above spray at 10 parts per million if later local marketing is his object.



Histogram showing results of experiments on irrigated and non-irrigated orchards

In the light of these recommendations it may be necessary for some growers to divide up their trees using all the fruit from some for one purpose and all the fruit from the remainder for another purpose.

In general it would appear that, although 245TP has its uses where fruit is to be placed straight on to the local market, NAA is a safe and effective stop drop spray if applied in the correct manner.

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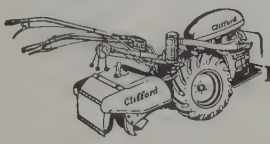

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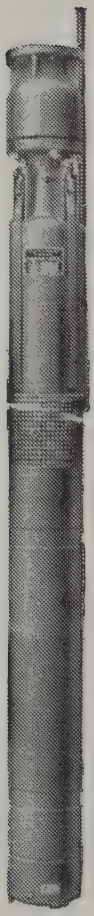

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Fig. 1.—A tractor, fitted with buckrake, being used to top up a silage pit

SILAGE COMPETITION, 1958-59

By H. G. ELLIOTT, Assistant Superintendent of Dairying

IN 1957, the Australian Dairy Produce Board Pasture Improvement Committee (W.A.) sponsored a silage competition with the object of encouraging the conservation of fodder in the form of silage and ensuring that the silage made was of a quality suitable for the maintenance of high milk yields during the summer months.

The success of the initial competition led to the organisation of another in 1958. This second competition was organised on slightly different lines, and was open to farmers who used silage mainly for feeding dairy cows.

The competition was in two sections and was conducted in the following six zones:

Zones—

1. Coastal.
2. Bunbury-Donnybrook.
3. Busselton-Margaret River.
4. Bridgetown-Nannup.
5. Manjimup-Pemberton-Northcliffe.
6. Albany-Denmark-Walpole.

In Section A (Quality) the silage was judged according to the following scale of points:—

	Points.
(1) Material ensiled (Botanical Composition)	15
(2) Maturity of herbage	25
(3) Colour	15
(4) Aroma	15
(5) Protein	30
Total	100

Section B (Workmanship in Making and Feeding) was divided into two subsections:—(1) Silage made in pits or clamps and (2) Stack silage. Material in each case could be long, baled or chopped. The scale of points in Section B was:—

	Points.
(1) Wastage	50
(2) Method of opening	25
(3) Convenience in feeding	25
Total	100

CASH PRIZES

Cash prizes of £10 and £5 respectively were given to the highest and second highest scorers in Section A (Quality) in each zone.

Prizes of £5 each were given to the top scorers in each of the two subsections of Section B (Workmanship) in each zone.

In addition, a championship prize of £25 was awarded on a separate judging, to the highest scorer in a competition open only to the zone winners in Section A.

There were 53 entries in each section of the 1958-59 competition which was judged by Messrs. H. G. Elliott, R. A. Bettanay, A. W. Hobbs, R. Sprivulis, B. Williams and A. L. Hamilton—all officers of the Dairying Division of the Department of Agriculture.

PRIZEWINNERS

Championship Award.

J. Brennan, Rosa Brook.

Section A.

Zone 1—	Points.
1st Brownes Ltd., Coolup	71
2nd D. Hodgson & Son, Waroona	68.5
Zone 2—	
1st M. and A. Bell, Elgin (i)	79.5
2nd M. and A. Bell, Elgin (ii)	77.5
Zone 3—	
1st J. Brennan, Rosa Brook	85
*W. J. Woods, Rosa Brook	83.5
*L. Le Souef, Margaret River	83.5
* Tied for Second.	
Zone 4—	
1st A. Read, Winnijup	59
Zone 5—	
1st M. McDonald, Northcliffe	73.0
2nd J. J. Littlefair, Pemberton	69.5
Zone 6—	
1st N. Barnes, Denmark (ii)	82.0
2nd L. King, Denmark	77.5

Section B, Subsection 1 (Pits or Clamps).

Zone 1—	Points.
Brownes Ltd., Coolup	80
Zone 2—	
J. Shine & Co., Brunswick	93
Zone 3—	
G. C. Beard, Witchcliffe	84
Zone 4—	
No Entry	
Zone 5—	
J. J. Littlefair, Pemberton	78
Zone 6—	
L. M. and D. C. Jones, Albany	96

Section B, Subsection 2 (Stack).

Zone 1—	Points.
J. Phillips, Coolup	78
Zone 2—	
M. and A. Bell, Elgin	82
Zone 3—	
J. H. Oldfield, Forrest Grove	81
Zone 4—	
Sale Bros., Balingup	78
Zone 5—	
*J. C. Waugh, Middlesex	68
*B. G. Dawson	68
* Tied for Second.	
Zone 6—	
N. Barnes, Denmark	88

JUDGES' COMMENTS

H. G. Elliott—Championship.

The silage which received the championship award was a mixture of subterranean clover and annual grasses submitted by Mr. J. Brennan of Rosa Brook.

It was harvested rapidly by a flail-type forage harvester and stacked in a shallow pit. No prior wilting of the green material was carried out and results indicated that sufficiently high temperatures were not obtained during making. However, the analysis showed high protein (21.2 per cent.) in spite of a high moisture content of 82.5 per cent.

On opening, the pit showed only a small amount of external wastage. As the type of harvester used precluded any great height being obtained in the stack, the maximum depth of silage in the centre was about 20 in. The colour varied from light brownish-yellow to greenish-yellow. Generally, the aroma was of an acetic acid type with a tendency towards a putrid aroma at the top and bottom of the pit.

Mr. Brennan said that all stock ate the silage readily, cows being fed approximately 60 lb. daily.

H. G. Elliott—Zone 1 (Coastal).

Of the three entries received in this zone, two were stacks made of long material and one a clamp with chopped material.

The material ensiled in all three entries consisted of subterranean clover, either mid-season or Yarloop, together with annual grasses including Wimmera ryegrass. In one case some oats were included in the mixture. It was obvious that the swards used in two entries were not uniform as many weeds were present.

Two entries were made from material which was cut too late as the grasses were over-mature. Two samples analysed

showed high moisture content of the silage due to the lack of wilting prior to ensiling. Excessive drying together with lack of sufficient compaction during making caused some over-heating in one entry.

With all three silages judged, the colour was not good and great variations occurred through the individual lots. Aroma varied considerably and none could be considered good.

The amount of wastage on the tops, sides and bottom was too high in every case and there was evidence in all entries that the finishing off was not given sufficient time. Lack of proper consolidation and sealing was obvious. Opening generally was done with a knife and too large an area exposed to spoilage. Feeding out was on the ground with the consequence that considerable losses occurred from both operations.

It is obvious that more care and attention is essential by all farmers when making and feeding out this valuable material.

B. Williams—Zone 2 (Bunbury-Donnybrook).

The competition results emphasised the necessity for adequate compaction and the exclusion of air to avoid mould growth. Mouldy silage is not a satisfactory feed for stock and the high percentage of waste in many stacks made them uneconomical in feed and labour costs.

The advantages of the forage harvester over the mower were particularly marked. The initial crushing effect of the forage harvester enabled better and more even packing of the material in the stack.

Cutting the silage on a face and feeding out away from the stack was obviously worthwhile as an economy feature, and self-feeding methods were not successful.

There appeared to be definite advantages in baled silage if it could be stacked so that there was no interlocking of the bales when the stack subsided. In this case the bales could be removed evenly on a face.

Farmers expressed appreciation of the opportunity afforded by the competition for discussing silage making and other phases of feeding and management.

All farmers stated that they will make silage again in 1959. Even those whose entries were criticised freely, appreciate the advantages of feeding silage in midsummer to prolong lactation; or in autumn before the new growth of pasture to make earlier calving possible. Farmers who have scored poorly are confident that much improvement can be achieved.

A. L. Hamilton—Zone 3 (Busselton-Margaret River).

As would be expected, considerable variation in composition was noted. Some entries were obviously cut from inferior pastures containing a relatively large proportion of silver grass, brome grasses, Yorkshire fog and other inferior species. These were low in protein according to analyses, and mature oats in two entries also gave low protein figures.

On the other hand the highest protein figures were obtained in silage made from highly productive pastures comprising 50:50 sub-clover and ryegrasses, or 40:60 sub-clover and mixed grasses including ryegrass, kikuyu, paspalum, etc.

While cutting a deteriorated pasture for silage is an excellent way of controling seed formation of the less desirable species it is important to remember that the quality of the silage, from the point of view of protein content, is closely linked with the quality of the material ensiled.

With only one exception, which was a "late" paddock, all entries were cut within the period October 20 to November 6. Even within this short period considerable differences in moisture content were encountered, ranging from 70.7 per cent. to 83.0 per cent. This wide range would indicate that a marked variation occurs in the stage of maturity of pastures and that it is necessary to study each paddock closely in order to cut at the best stage of growth.

It is of interest to note that the silages which contained 81 per cent. to 83 per cent. moisture (six samples) contained an average of 16.5 per cent. protein; 75 per cent. to 80 per cent. moisture (five samples) averaged 14.9 per cent. protein, and 70 per cent. to 75 per cent. (four samples) averaged 12.1 per cent. protein.

These figures seem to show that high protein is obtained by cutting pasture while the moisture content is still high i.e. before the plants fully mature and commence drying out.

The best entry in Section B (1) was a pit of material cut in mid-November from a late paddock using a forage harvester. The

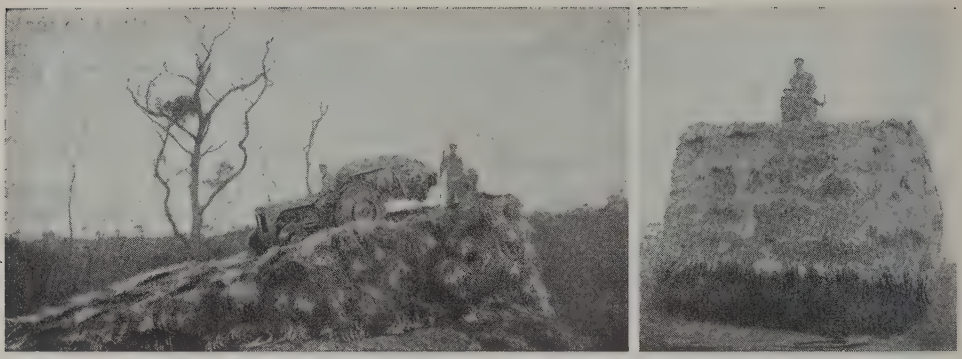

Fig. 2.—Side and end views of one of the popular wedge-shaped silage stacks

depth of material in the pit when inspected in May was a little over three feet, and the top surface which was covered with soil after compaction revealed not more than 1½ in. of waste when the soil cover was removed.

The best entry in Section B (2) was a stack of long material gathered with a buckrake and the prevention of waste by using a topping of lush material to seal the stack was exemplified in this silage. The silage itself was very uniform and care was obviously used in making to ensure even compression over all portions of the stack. Wastage at ground level was practically nil.

There was evidence, however, in other entries, that farmers had "hastened too quickly" in the actual building of the stack, whether above or below ground level, and that more attention to spreading and levelling the material between loads would have repaid the extra time and effort.

Perhaps the major cause of waste was the failure to satisfactorily seal the stack from the air in order to prevent mouldiness and drying out. In several instances at least 9 to 12 in. over the whole surface of the silage was quite useless, which considerably reduces the proportion of nutritous material available for feeding out.

A. W. Hobbs—Zones 4 and 5 (Bridgetown-Nannup and Manjimup-Pemberton-Northcliffe).

Although only two entries were judged in Zone 4 and four in Zone 5, more farmers in these areas are making silage than in previous years. The majority are sheep and fat stock raisers and did not enter the competition.

In these areas, the quality of the silage is apt to be governed by the availability of contract machines and labour, also the weather conditions at the time of silage making. Late arrival of the contractor can lead to the ensiling of over-mature material.

Entries in these two zones included bun stacks with material both mown and forage harvested. A trench silo filled by means of a buckrake and another in which forage harvested material was dumped and spread with a drag fork were successful in gaining awards.

Lack of adequate consolidation and faulty sealing led to considerable wastage in some instances.

Most competitors fed out the silage by cutting it into slabs with a hay-knife or broad-axe, forking it on to a trailer and then forking it off into the paddocks from behind a slowly-moving tractor. Several farmers in this area (not competitors) tried self-feeding the silage using moveable feeding racks or electric fences but the wastage was heavy in each instance.

R. Sprivulis—Zone 6 (Albany-Denmark-Walpole).

There were 17 entries in Zone 6 and the quantities of silage conserved in single pits or stacks varied considerably, the maximum being 60 tons. The largest quantity made on one farm was 110 tons.

The winning entry consisted of an almost pure stand of mid-season sub-clover

with only a very small admixture of annual grasses and a few dock plants. The clover was at the early flowering stage when cut.

A wedge-shaped stack was built on a hillside using the buckrake for carting the material which was then consolidated by using the tractor in a herringbone pattern.

A layer of succulent subclover was used to seal the top layer, being rolled into a well-compacted layer two to three inches thick. The wastage on this stack did not exceed 8 per cent. and occurred mainly along the sides.

Most entries in this zone suffered through failure to allow succulent clover time to wilt before being ensiled. This resulted in a rather wet and putrid-smelling silage. Where grasses predominated, the consolidation was usually insufficient.

Surface sealing was not done properly by a majority of farmers and initial losses of 20 per cent. due to moulds were very common. Where more care was taken in compaction and surface sealing, losses did not exceed 8 per cent. Old bags were spread over the top of a stack and covered by 6 in. of sand by one farmer. At feeding out time, each bag could be removed separately taking the soil cover with it. This practice gave good results.

Succulent sub-clover also gave good results as sealing material being quite as effective as the use of bags and soil. In each instance, the initial losses did not exceed 3 in. on the surface. On the poorly compacted and badly sealed stacks, initial losses went as deep as 2 ft. 6 in. on the surface. No excessive losses were observed in pit silage.

One farmer at King River baled his silage material and ensiled the bales in a trench, covering them with soil by the use of a blade attached to the front of his tractor. This method of sealing was simple and effective.

For feeding out, the soil was removed by the tractor and blade. The handling and rationing of the baled silage was much easier than when handling loose material, whether this was long or chopped.

GENERAL COMMENTS

It is obvious from discussions and watching farmers' operations that the forage harvesters speed up the work of making silage but the problem of transport of the material harvested must be worked out before the full advantage can be obtained from the machines.

Much discussion has taken place among farmers and others concerning the effect this method of harvesting green material may have on the quality of the silage, but it can be generally stated that the chopping and lacerating action of these machines seems to have a beneficial effect on the quality of the silage, if the moisture content of the material is right, and the control of temperature, method of packing, and consolidation are correct.

From the results of this competition it would appear that more care and attention should be given to the following points when making this very valuable material:—

(a) Cut at the time when the bulk of the material is at the early flowering stage.

(b) With forage harvesting machines try not to harvest when surplus moisture is present on the green material, and so avoid excess moisture in the silage.

(c) Wherever possible wilt very green material to reduce moisture if possible to 70-75 per cent. and not 80-84 per cent, as frequently found in silage.

(d) See that the correct temperature is obtained in the early stages of making the silage. Temperatures of between 100-115 F. should be obtained and maintained during making.

(e) Greater care should be taken to avoid excess wastage on the sides and tops of clamps, pits and stacks by better attention to filling and finally sealing off. Where adequate sealing of the top of the silage with very lush green well-rolled material is not possible, earth should be applied.

(f) Better packing with forage harvester material must be practised to avoid excessive wastage.

(g) Do not expose too great a surface area when feeding out during the summer, as this causes drying out and further wastage.

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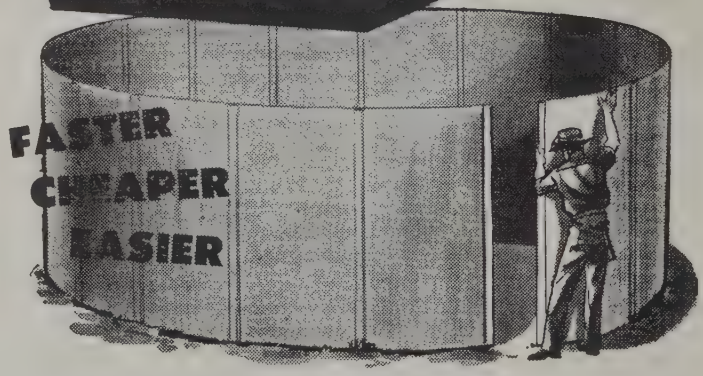

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Plywood for STRENGTH

Fig. 1.—General view of light land development in Badgingarra area (1957)

CLEARING SANDPLAIN COUNTRY

By B. F. CARLIN, B.Sc. (Agric.), Agricultural Adviser

THE greatest scope for development of new land in Western Australia lies in the millions of acres of sandplain country along the west and south coasts and to a lesser extent in the Newdegate area. With the development, or at least alienation, of the South-West and the wheatbelt nearing completion, attention has been focused on these tracts of sandplain country.

The accompanying map shows the areas of light land available for development in Western Australia.

Most readily developed are the soils with clay or gravel within two feet of the surface. These soils hold moisture and fertilisers more readily than deep sands. Deep sands, particularly white and grey sands, should be avoided wherever possible. The climate throughout is Mediterranean with a wet winter and dry summer. The growing period varies from about five months west of Mingenew to about eight months in the Esperance region.

DEVELOPING A NEW BLOCK

The successful development of a new block requires a combination of three factors.

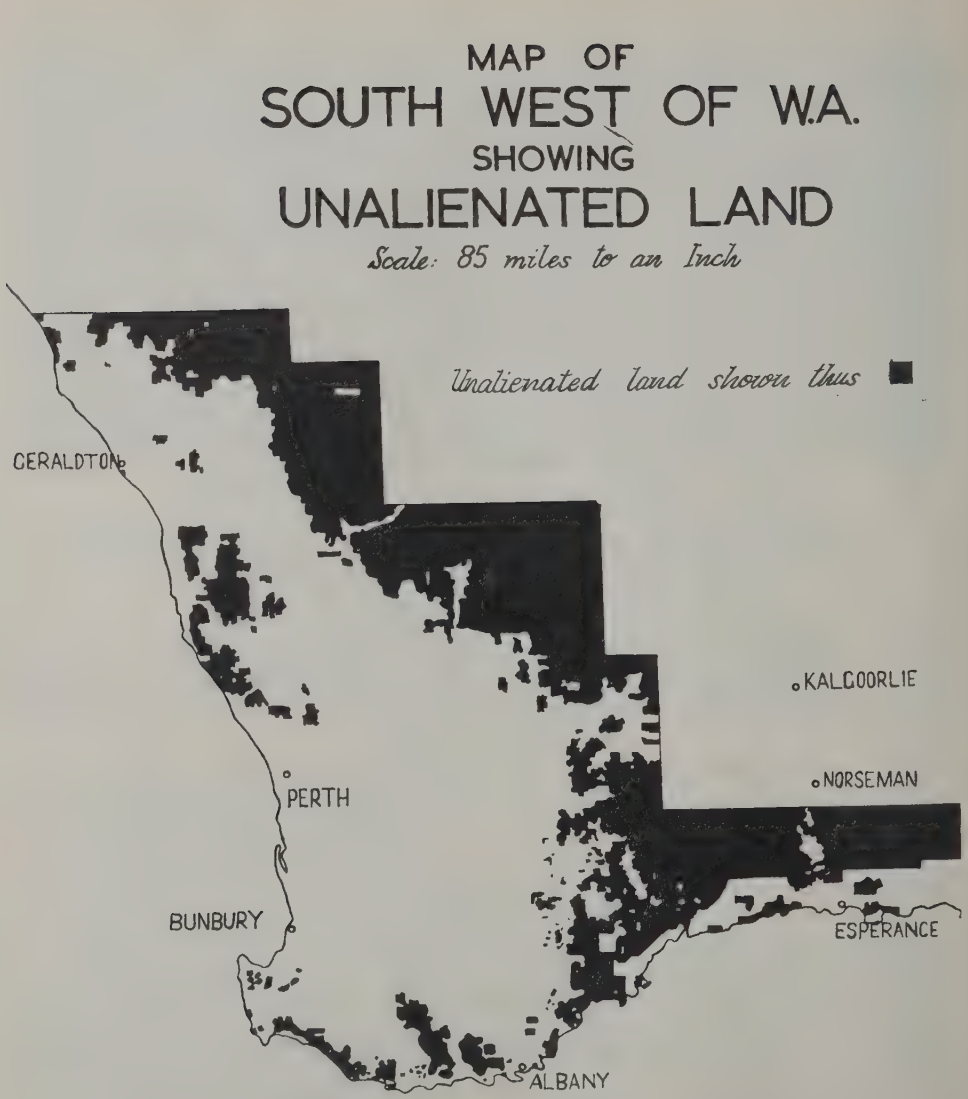
(a) Adequate capital.
(b) Careful planning.
(c) Technical "know-how."

Obviously, the settler must have sufficient capital to clear, cultivate, supply seed and fertiliser, supply capital improvements, and provide for living expenses during the development. Even where cereal crops can give a cash income, substantial capital backing is still necessary.

Equally important is a systematic plan of development. The settler should at all times "know where he is going." Development should always we kept within the physical and financial resources of the farmer. Systematic development and consolidation is essential so that the greatest return can be obtained for each pound invested. Two obvious dangers are having too much cleared too quickly for control of regrowth or for adequate fertiliser application to pastures. By planning ahead for five years the settler can prepare working schedules for this period and budgets showing expected expenditure and receipts for each year.

Again, the settler requires a lot of knowledge in regard to the handling of light land and the sowing of suitable crops or pastures for his particular block.

We all know of settlers who have failed because they fell short of the mark in relation to one of these three factors.



CLEARING THE BLOCK

There are three steps to be followed in the successful clearing of a scrub plain block. These are:—

(1) Burning.
(2) Cultivation.
(3) Cropping to cereals and stubble burning.

Of course cropping is only suitable in some areas, but each of these steps is of vital importance. It is essential that each operation be carried out thoroughly so that full value is received for any expenditure made. This thoroughness, or efficiency of operations, is the keynote of development once requirements in regard to capital and planning have been met.

1. Burning.

Clean burning of all scrub growth is highly desirable. Growth of crops and pastures will be much poorer where the

harsh native scrub has not been removed, and burning is the most effective means of removing this material cheaply. Crops will suffer more from nitrogen deficiency and sub. clover pastures will suffer more from "seedling mortality" where the scrub is inadequately burnt.

The first step to take in burning, is to put a good firebreak right around the block. In scrub country, this will ensure that the only burning done on the block is that planned by the settler. All too often one sees large areas of sandplain burnt out and the subsequent development of blocks in such areas is rendered very difficult.

To obtain a good burn, it is important that the scrub be knocked down or laid over. This is most readily done by rolling the country with a cleated scrub roller, by chaining the country with an anchor chain dragged between two tractors, or by dragging a heavy log behind a tractor. Whichever one of these methods is chosen will depend on the resources of the farmer and the country being dealt with.

Fencelines should be well cleared. Two years of bare fallow is an advantage for fencelines. All too often we see fences put up in a hurry and later overgrown by scrub as a result of poor clearing. Firebreaks and fencelines can be planned at the same time.

In blackboy country it has been found necessary to use specially-arranged logs. These devices depend on one blow loosening the blackboy and a second one pulling it out of the ground. One such arrangement, commonly in use, consists of two parallel logs with the second log eight feet behind the first. The size of log used will vary according to the vegetation, soil type and available power. In the case of the blackboy country it is better left another year so that the blackboys burn completely.

The best time for chaining, rolling or logging is in the winter when the roots of much of the scrub are dragged free. Burning takes place at the end of the following summer.

In tussocky sandplain there is often no scrub to knock down. Efficient burning in such cases is obtained by winter ploughing and fire-harrowing at the end of the following summer, Fire-harrowing enables a fire to be taken across land where a fire would not run and is a valuable aid in burning some types of plain. On tussocky sandplain the fibrous roots are burnt up in fire harrowing.

2. Cultivation.

The initial cultivation should be done towards the end of winter with a good heavy disc plough. Ploughing should be to a depth of four to five inches and should be deep enough to be under the main root zone of the native scrub. Ploughing at this depth is not detrimental to the soil and

Fig. 2.—Fire harrowing ploughed-in sandplain west of Winchester

Fig. 3.—Wheat crop on poorly prepared country in Badgingarra area

it is most important to root out as much as possible of the native scrub. The bare fallow period following ploughing aids in clearing the land and ensures better crops and pastures subsequently. Where possible roots and sticks should be picked up and burnt.

In the following autumn, the land should again be disc ploughed to a similar depth. Where necessary fire-harrowing should be carried out.

Following on a good burn, or with fire-harrowing, these two good cultivations should ensure that the scrub is well under control and that subsequent crops and pastures make satisfactory growth. The bare fallow period allows the breakdown of some organic matter and the build-up of available soil nitrogen. These benefits will be much greater if the first ploughing is done when the soil is really wet.

3. Cropping.

In some areas, cereal cropping on new light land is quite profitable. West of Midland Railway line, and in the drier portions of the southern plains, it is recommended that a cereal crop or, preferably, two crops be grown before pastures are established. Along the south coast crops have not been so promising and pastures, based on sub. clover are established on the bare fallow.

Fig. 4.—Good clean fallow after a good burn on new land in the West Midlands

Fig. 5.—Healthy wheat crop on well prepared new land north of Badgingarra

Where crops can be grown they give four main benefits to light land development.

(a) Crops help to defray the cost of developing new land. A cash return in the first year is obviously most desirable.

(b) Cropping aids clearing and the control of regrowth. A good stubble burn after the crop kills or checks nearly all regrowth. The first burn promotes the germination of poison plant seedlings. These are generally controlled by the two subsequent ploughings. A stubble burn promotes a further germination of poison plants which are then controlled by further ploughing.

(c) Cropping allows time for any remaining organic matter to decompose and for the soil to become more "civilised." In drier areas where cropping is practicable it is common for "seedling mortality" to be serious in sub. clover establishment. It is known that sub. clover is more readily established on older land and this time angle is most important.

(d) Another benefit of cropping is that it lays the foundation of a fertiliser bank before the establishment of sub. clover pastures. An initial sowing of sub. clover after two crops with liberal dressing of superphosphate and trace elements will nearly always be successful. The aim should be to use 1 bag of copper and zinc super to the acre with the first crop and not less than 150 lb. super to the acre with the second crop. Wheat crops in this area can be expected to yield between nine and 16 bushels of wheat to the acre.

COSTS

It is not proposed to deal with costs in detail but an example of costs at contract rates in the West Midlands will give some idea of costs to be expected.

Cost of Planting first Wheat Crop.

	An Acre £ s. d.
*Logging or Rolling	0 5 0
Burning and provision of firebreaks	0 2 0
Initial Ploughing	0 15 0
Second Ploughing	0 12 6
Seed (45 lb. wheat an acre)	0 12 6
Super (1 bag Cu/Zn super an acre	1 18 0
Drilling	0 10 0
Harvesting	1 0 0
	5 15 0

*It is often unnecessary to log the whole area as some areas carry very short scrub which does not respond to logging.

Subsequent costs will include pasture establishment, fencing, buildings, water supplies and pasture topdressing. The report of the Esperance Down Development Advisory Committee published by the Government Printer sets out suggested costs for development of light land farms where pastures are established after the initial fallow period.

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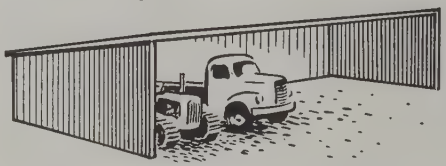

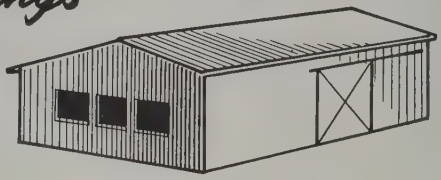

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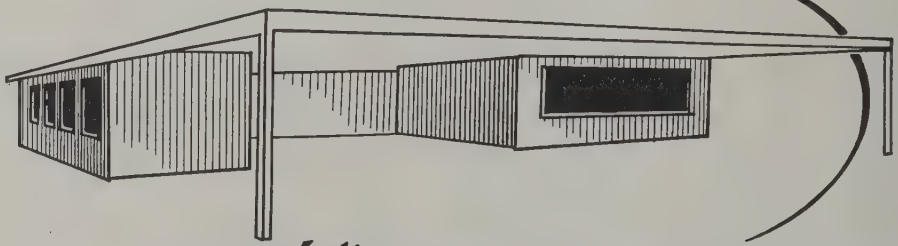

A skillion sports pavillion

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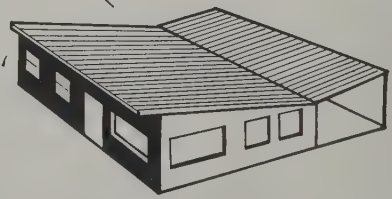

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GETTING THE BEST OUT OF CONCRETE

STEEL and concrete are two of the most widely-used materials in the world today but although most laymen know that the steel technologist uses various additives to give him steels that are especially suited for certain tasks, it is not generally realised that there are a number of preparations which, added to concrete, make it especially suitable for use under certain conditions.

Concrete, as known to the farmer and home-builder, may be briefly described as a synthetic stone made from Portland cement, sand, gravel, or other aggregates, mixed with water and allowed to "set."

In this form, it possesses many good qualities, being durable and reasonably impermeable, but in recent years the scientists have evolved a number of additives and surface treatments which have greatly widened the scope of its usefulness.

NON-SLIP GRAINS

Dairy floors, concrete steps and pavements may be given a non-slip surface by treating them with special grains made from a mixture of carborundum and aluminium oxide.

On new work these are applied to the cement mortar topping which is usually applied within 48 hours of the laying of the basic concrete. The topping is usually made from a three to one mix of river sand and cement and within 15 minutes of the topping being screeded and compacted, the grains are broadcast on the surface at the rate of about 3 lb. per square yard, with an equal volume of dry cement. The surface is then compacted with a wooden float and trowelled to a dense finish with a steel float.

CASE-HARDENING

If your concrete is likely to encounter a lot of hard wear you can increase its normal resistance to abrasion by giving it two coats—at six-hour intervals—of a special case-hardening compound.

This treatment may be applied in addition to the non-slip grains—the first coat being applied not less than 48 hours after the trowelling of the non-slip surface. It may be sprayed on or applied with a hair broom.

You need not stop at this in your endeavour to create a perfect floor for a dairy or shearing shed for there is yet another dressing which will make the concrete still

more resistant to lactic acid, wool grease and urine. This may be applied on the day following the last coat of case-hardening fluid.

Old concrete can be successfully treated with case-hardening fluid and the oil and grease proof dressing.

PROOFING AGAINST OIL

For the floors of factories, garages and workshops there is a special dressing differing chemically from that used for dairy floors. It will proof the concrete against penetration by liquid fuels, solvents, lubricating oils and grease.

These substances stay on the surface instead of being absorbed by the concrete. Even if left for a considerable period they will wipe off cleanly and completely as if from a marble surface.

This treatment is being extensively used by the leading oil companies.

WATERPROOFING

An integral waterproofing substance which is mixed into the cement is proving very popular for many tasks. For making a waterproof mortar used in rendering walls or treating tanks or troughs, one-third of a gallon of the waterproofing compound is used with each bag of cement in the three to one sand and mortar mix.

BONDING

Another chemical aid for the concrete worker is a special bonding agent which provides the "flux" to make concrete adhere to older work or to metal. It is particularly useful when putting a new "topping" on an old floor or when lining an old rusted tank with concrete.

Before applying new topping, an old floor should be thoroughly scrubbed down. It should then be painted with the bonding agent and left for four to six hours after which the topping (a three to one mortar mix) is applied and floated. The topping should not be less than one inch thick. One or all of the non-slip grains, case-hardening and grease-proofing dressings may be applied as described earlier.

CEMENTING TANKS

The tank should first be inspected to ensure that no large cracks or corrosion failures are present. If so, these should be repaired before the actual lining is commenced.

First thoroughly scrub down the inside of the tank with a wire brush to remove all loose material and slime, and finish by washing and flushing with clean water. Allow to dry for one day and then apply the following treatment for lining.

A liberal coat of a bonding agent should be applied over the walls and bottom of the tank, paying particular attention to joints between plates and between the bottom and sides. The bonding agent may be brushed or sprayed on and a coverage of 400-500 square feet per gallon is usually obtained. Allow the bonding agent to dry to a tacky film, usually taking two to four hours.

A waterproof mortar, consisting of three parts sand to one part cement with one-third of a gallon of integral waterproofer for each bag of cement should then be mixed to a stiff mortar and applied evenly over the entire inside surface of the tank. For smooth surfaces, such as concrete or steel plate tanks, this should be applied to a minimum thickness of ½ in., and in case of corrugated iron tanks a minimum thickness of ½ in. over the ridges of the corrugations. It should be noted that if it is not possible to complete the job in one application, it will be necessary to apply the bonding agent to the joint between the old and new mortar to ensure a bond, as the waterproof mortar when dry has practically no "suction."

The lining should be allowed to dry for four to six hours and should then be kept damp by hessian or water spray for several days. If necessary, the tank could be carefully filled on the second day and, by avoiding turbulence there would be no serious effect on the render.

Proceed similarly for troughs.

APPROXIMATE QUANTITIES

Type of Tank	Sand	Cement	Bonding Agent	Waterproofer
	cu. ft.	bags		gal.
500 gal. steel or concrete	4½	1½	½ gal.	½
1,000 ,, ,, ,,	6	2	3 pints	¾
2,000 ,, ,, ,,	10	3¾	5 pints	1
5,000 ,, ,, ,,	18	6	1 gal.	2

Corrugated galvanised iron tanks require 1½ times the above quantities.

Mr. H. M. LISTER

Mr. H. M. Lister Retires

Mr. Harold Montgomery Lister who retired from the Dairy Division of the Department of Agriculture in July of this year, was born in the city of Leeds in 1895 and received his primary and secondary education at the Leeds Modern School. He attended the Leeds University before coming to Australia, where he gained considerable experience in various dairy produce factories in Victoria, ultimately becoming foreman and assistant manager of a large dairy company at Foster, and manager of the Bradford Dairy Company.

In 1929 he came to Western Australia as manager of the Bunbury factory of the South-West Co-operative Dairy Farmers' Ltd. On the erection of the small dairy produce factory at Muresk Agricultural College and the inauguration of the course for the Diploma in Dairying, Mr. Lister was selected to occupy the post of superintendent. In this position he was responsible for the training of a number of young men who are now making their contributions to the dairy industry in dairy produce factories and in various administrative posts.

Owing to the exigencies of wartime no students were available for the dairy course in 1942 and when a crisis arose regarding the export of surplus eggs, the Commonwealth Government decided to erect an egg-drying plant in West Perth.

Mr. Lister was transferred to undertake the organisation of the installation of equipment and the operation of the plant and continued in this position until 1946 when he returned to the Muresk College to recommence the Dairy Course.

In 1954 he was transferred to the headquarters of the Department of Agriculture in Perth as the Officer-in-Charge of Dairy Factory and Produce Supervision. His duties included the administration of the Dairy Industry and Margarine Acts, the direction of the operations of the Dairy Laboratory, and the activities of Dairy Instructors, responsible for farm dairy inspection.

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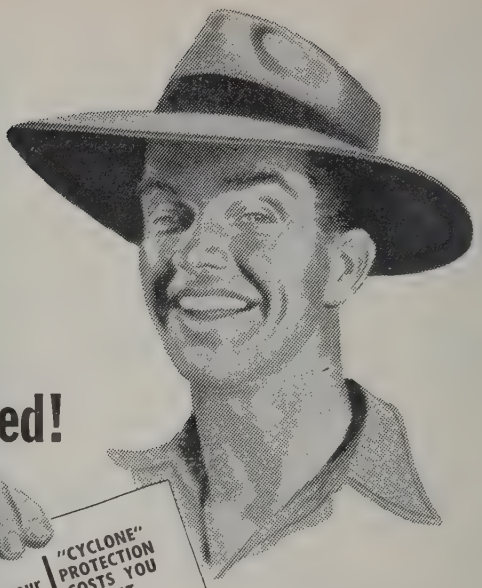

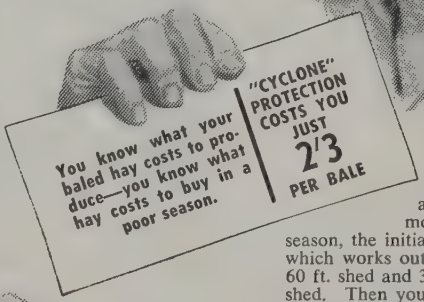
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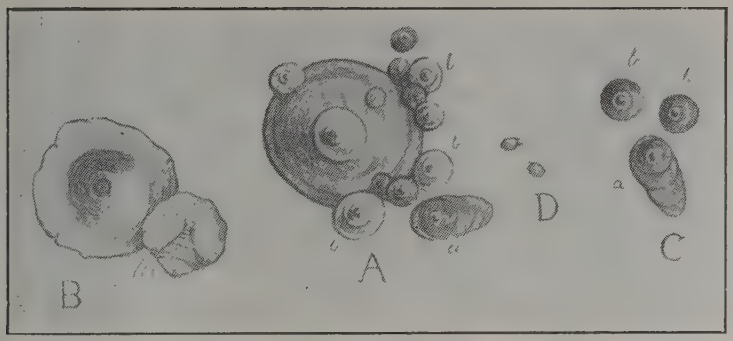

Fig. 1.—Various stages of San José Scale, all enlarged about 15 times. A—Adult female scale with immature young of various stages settles around and upon her; B—An adult female scale turned over revealing the insect herself with the bristle-like mouthparts exposed; C—An adult male scale with two immature winter-stage scales; D—Young crawlers soon after birth

Some Experiments on San José Scale Control

By G. D. RIMES, B.Sc., Entomologist.

WITH the rejection by export fruit inspectors of 13,500 cases of apples during 1959, due to the presence of San José Scale, attention has suddenly been focussed on the importance of San José Scale to the W.A. fruit grower.

San José Scale (*Quadraspidiotus perniciosis*) was originally introduced from China to America about 1870. It was described from this country and was thus given an American name. As late as 1926 it was described as the most destructive fruit pest in several states of the U.S.A. and was one of the causes for rapid development of spray machinery. The transport of infested nursery stock over long distances has made this pest almost universal in distribution. However, a few European countries have escaped infestation and these have placed strict quarantine barriers against the entry of San José infested fruit. As a result of this the control of scale has become a first priority in orchard practice.

DESCRIPTION

The San José Scale attacks all parts of the tree, including the fruit, as well as the bark from the base of the tree to the terminal twigs. On the bark the female scale is the one usually seen, and is grey and circular in appearance, with a central raised nipple which may be of a lighter or darker nature than the surrounding area. The size of the scales will vary due to the presence of several generations at different stages of development, the mature female being approximately 1/10th of an inch in diameter. Smaller, elongate male scales are occasionally interspersed with the females. The scale is readily detached to show a small shield-shaped, legless insect attached to the underlying plant tissue. This approximates in texture and colour a minute piece of lemon fruit tissue. Occasionally upon removal, the long thread-like mouthparts, which are embedded in the plant tissue, are shown, but usually they are severed when the insect body is moved.

The male insect on development is a free-living winged form, and exhibits thread-like plumes which form a tail characteristic of many scale insects. They are very weak intermittent fliers. When jarred from their host material, they fly to the ground in a descending spiral course. Walking is the chief form of locomotion.

HOST PLANTS

San José Scale has been listed from some 700 host plants. The most commonly-infested trees are apple, pear, peach, plum, nectarine and cherry. However almost all deciduous trees and shrubs may be hosts at some time or another and should always be sprayed, if adjoining an orchard property. Rose bushes and pussy willow have been found bearing San José Scale in local areas.

INJURY TO HOSTS

San José Scale occurs on all surface parts of the host from ground level to the tips of the shoots. They may occur in large numbers under the loose bark butts of trees, in which situation they are well protected from the external environment and spray materials. Ascending crawlers may disperse from these areas and invade suitable wood during the spring and early summer. Where high populations are encountered the infestation may easily be overlooked as the entire bark surface may be covered with the scurfy layer, which superficially resembles the natural bark. Up to 100 scales per square inch have been counted from locally infested trees. Heavily infested trees shed their leaves and gradually die. More often certain limbs become infested and die, before the whole tree is affected. This death process has been observed in the Roleystone area on peach trees, and follows a definite pattern. The leaves turn a lighter colour and are shed, this quite often being followed by cracks in the bark which exude large masses of gum. A secondary fungal infection may follow. Any suspected die-back in an orchard should be carefully examined for the presence of San José Scale. Following the successful eradication of scale from the heavily infested tree or limb, the branches and buds may be weakened to the extent, that no fruit is borne for a season or two.

Where crawlers settle on fruits to mature, a characteristic halo-like red discoloration rapidly appears. This red ring remains in evidence after the scale has been removed and is a telltale sign of the scale's presence at one time or another. The calyx and stem cavities of apples and pears are preferred by the scale. A reddish discoloration is also seen occasionally on the tender Yates and peach wood. Where suspected scale is seen, removal of the outer layers of bark, in these two varieties, will show a bright red discoloration of underlying plant tissue.

The normal orchard practice of dormant spraying keeps San José Scale to such low levels of population that no damage is suffered by trees. However due to the stringent quarantine regulations of some overseas countries the presence of a single scale is sufficient to cause the rejection of an export line.

LIFE CYCLE

The normal scale in evidence on the tree is the female scale. This gives rise to living young, known as crawlers, which lead an active life, having well-developed legs and antennae. Microscopic examination of locally-collected mature female has shown up to 20 developing embryos within the parent body. The liberation of the young may occur for some weeks, during which period large numbers of crawlers are liberated. Accurate figures have not been determined locally but an American worker, Marlatt (1906) places the average figure at approximately 400 in U.S.A., while Ludicke (1950) found that from 50 to 200 crawlers were produced per female in Germany. The young spend some time under the parent scale before assuming a free life. Under local conditions crawlers have been traced from the butt of peach trees to the upper limbs, a distance of some 6 ft. The distance travelled is no doubt influenced to a large degree by the nature of the surface and temperature and humidity of the day. Many crawlers however will settle in the immediate vicinity of the parent, or beneath the parent scale.

The free life may last up to two days but the majority of crawlers become attached in a much shorter time. A loose protective wax-like scale has been observed, in local orchards, to be deposited with 24 hours from birth. At this stage the legs and antennae are folded beneath the body. The scale gradually becomes darker and after two to three weeks becomes black, at which stage it is known as the black-capped stage. A moult occurs at this stage and the body appendages are shed. This first stage nymph has a uniform dark scale without any irregularities, and it is this stage that is the main overwintering stage in Western Australian orchards. The first stage nymph undergoes a second moult before reaching maturity. The total life cycle occupies approximately six weeks from crawler to adult in peak summer conditions in Western Australia.

Under local conditions the overwintering stages were found to be females containing partially-developed embryos, as well as first stage nymphs formed from the last summer generation. These gravid females liberate crawlers in mid to late October, crawler activity being readily observed in the Bridgetown area during the period

13/10/58 to 23/10/58. The overwintering first stage nymphs begin rapid development with the onset of the warm weather and reach maturity in December. The October crawlers also mature during December, thus giving two overlapping generations which give rise to the economic menace.

It appears that four generations occur during the summer months with gravid females from the fourth generation overwintering, as well as first stage nymphs from an abbreviated fifth generation.

Unusual climatic conditions may considerably change the above generation postulate. The abnormally long summer experienced during 1959 has resulted in successive generations being developed during what would normally be considered a dormant period. Crawler emergence has been observed as late as July 3. This means a much greater initial population threat to the approaching 1959-1960 season.

The males are free living winged forms and developed beneath a scale in a similar fashion to the female scales. When fully developed the male emerges from the scale covering and assumes a free life. The males copulate with the fully-developed female scale.

DISPERSAL

San José has become almost universally distributed by the shipment of infected nursery stock and fruit. Distribution in local areas by its own means is limited, due to its very short free-living stage, and its rudimentary locomotion. Adjoining trees may infect one another where branches touch.

There is no doubt that the main methods of dispersal within orchards and neighbouring localities are due to wind, birds, insects and orchard personnel.

SOME EXPERIMENTS AND TRIALS ON SAN JOSÉ CONTROL

Dormant Spraying Trial.

The universally-accepted materials for San José Scale control being either lime-sulphur or dormant oil, it was decided to test these materials in large-scale field trials. Three commercial orchards were obtained in various apple-growing areas, viz. Pickering Brook, Bridgetown and Manjimup, the total area being 32 acres comprising mixed apple varieties and stone fruits. These orchards were sprayed by Departmental officers in late August with lime-sulphur 32°—33° Beaume diluted at 14 gallons to 100 gallons water. This was followed in mid-September with Superior dormant oil at the rate of 3 gallons to 100 gallons of water. All trees were sprayed to "run off" approximately 2 gallons per tree being applied.

The harvest from the Pickering Brook and Bridgetown orchards were thoroughly examined and the effectiveness of the materials assessed. The majority of export lines were clear of scale, although an occasional line was rejected. The Yates varieties from both properties was most seriously affected. A noted reduction in scale occurrence was obtained in both orchards, probaly due to the amounts of material used and the unusually thorough application of the spray material. However the dormant treatments used, although giving an excellent economic control of San José Scale, were not sufficiently effective to achieve the almost total eradication necessary, to meet the strict export requirements.

Malathion—Sumer Treatment Experiment.

A block of 60 Yates trees were selected with uniform infestation of San José Scale. Two dormant treatments, one of lime-sulphur and one of superior oil were applied. A summer treatment in mid-February of malathion at the rate of two pints of 20 per cent. per 100 gallons was applied without any white spraying oil to alternate trees. Spraying oil was omitted due to the uncertainty of the reaction of malathion with white oil in the spraying vat. There is a tendency for organic phosphates to undergo hydrolysis in alkaline conditions, such as are encountered when they are mixed with white oil. This matter was later investigated by the Government Analyst and the degree of hydrolysis found to be negligible under normal working conditions. However insecticides of this nature must not be left mixed overnight and to avoid anything untoward, it would be advisable to use one of the newer neutral pH. superior summer spraying oils.

The trees were sampled by picking two cases of fruit from each tree, which could be readily reached from ground level.

Each apple was examined for the presence of scale. Thirty trees from the centre of the block were sampled.

Treatment	Scales Present per Sample															Total	Total $\sqrt{x + \frac{3}{8}}$
Malathion 0·05%	0	0	0	1	0	1	0	0	2	0	0	1	0	1	1	7	12·914
Control....	3	1	2	2	1	1	2	2	3	3	2	2	0	2	0	26	21·041

Analysis of Variance ($\sqrt{x + \frac{3}{8}}$ Transformation)

Variance Due to	D.F.	S.S.	M.S.	V.R.
Sprayed *v* Unsprayed	1	2·201604	2·201604	17·05***
Error	28	3·615566	0·129127	....
Total	29	5·817170	..	....

Conclusion.

The numbers of San José Scale on the fruit from the sprayed trees were significantly less than the numbers of scale on the fruit from the unsprayed trees.

Summer Control Experiment.

A replicated experiment was laid out at Stoneville Research Station to test the effectiveness of Parathion, Gusathion, and Diazinon as summer controls. Dormant treatments of lime-sulphur and Superior oil had been applied in August and September. The summer treatments consisted of the above materials at 0.05 per cent. conc. together with white oil at the rate of 1¼ gallons per 100 gallons spray. The experiment was laid out on a block of Granny Smith apple trees and consisted of the three insecticidal treatments plus control, replicated 12 times, in a randomised block design.

The summer treatments were applied in the 1st week of December and repeated during mid-January.

Two hundred cases of fruit were picked during the sampling of the experiment and each apple examined for the presence of scale. No live scales were present.

At the time of sampling many trees had live scale present on their limbs. This indicated that the sampling technique of examining apples for the presence of scale was of little value in testing these insecticides, when Granny Smith varieties are used. The problem of varietal susceptibility in apples needs investigation. A similar population on Yates and Granny Smiths, will yield a high incidence of scale attack on the Yates fruit, and little or none on the Granny Smith variety.

Summer Control Experiment.

A replicated experiment was laid out at Roleystone on December 2, 1958 to test various insecticides as summer controls. The orchard had been given a dormant treatment of lime-sulphur. Uniformly infested apple trees were selected and divided into blocks. Six treatments were replicated five times. The following insecticidal treatments were applied at a 0.05 per cent. conc. together with summer spraying oil at 1 gallon to 80 gallons spray:—Malathion, Diazinon, Parathion, Trithion, Gusathion.

Sampling was carried out six weeks later by counting the live scales from four twigs from the four compass points on each tree.

It was decided that it would be more appropriate to apply a range test to these treatment means rather than a direct comparison of individual means using a "t" test.

Conclusion.

All treatments are significantly better than the control at the 1 per cent. level. Parathion is significantly better than the

An $\sqrt{x + \frac{1}{2}}$ transformation yielded the following data.

———	Control	Parathion	Malathion	Gusathion	Diazinon	Trithion	Total
Total Scales all blocks	563	20	162	46	50	192	....
Total $\sqrt{x + \frac{1}{2}}$	99·5234	18·3684	45·7943	28·0921	27·8432	54·7022	274·3236
Mean	4·9762	0·9184	2·2897	1·4046	1·3922	2·7351	2·2860

L.S.D. treatment means: $P < .05 = 1.2869$. $P < .01 = 1.7551$ $P < .001 = 2.3751$.

Malathion and Trithion treatments at the 5 per cent. level but not significantly better than the Gusathion or Diazinon treatments.

Metasystox Summer Control Trial.

An experiment was laid out during January 1959 to determine the value of Metasystox as a summer control for San José Scale. An area of heavily-infested peach trees was selected at a Roleystone orchard and divided into eight blocks. Four blocks were treated with metasystox at a concentration of 2 pints per 125 gallons, and four blocks were left untreated as a control.

Sampling was commenced four weeks later and consisted of counting live and dead scale from a selected number of twigs from each tree.

The complete trial was not sampled as it rapidly became obvious that the mortality was so slight, when compared to previous tested materials, as to have little, if any, commercial application.

Post-harvest Spraying Experiment.

Three blocks of Yates trees were selected in a commercial orchard in the Karragullen area for the post-harvest spraying trial. A continuous infestation occurred through out each block. Block A was treated with Diazinon at the rate of 0.05 per cent. plus Superior oil at the rate of 3 gallons per 100 gallons. Block B was used as control, and Block C treated with Gusathion at 0.05 per cent. plus Superior oil at 3 gallons to 100 gallons. The treatments were applied during the week May 6 to 12, 1959, some two weeks after the final harvest.

Sampling was carried out four weeks after spraying and consisted of cutting four twigs from each tree at the four compass points and counting the numbers of live and dead scales on each twig. The 27 trees of each block were sampled.

The following table gives total scales per block, alive and dead.

	Dead Scales	Live Scales	Chi-Squared
Block A Diazinon	131	34	42·1426
Block B Control	159	555	33·6227
Block C Gusathion	371	18	44·1114

A chi-squared analysis was used for comparison.

Test of significance of Treatment Effects

Chi ²due to	D.F.	²	$\frac{x^2}{\text{D.F.}}$	V.R.
Treatments	2	595·7669	297·88345	193·82***
Diaz, *v* Gusathion	1	11·8539	11·85390	7·71**
Control × D & G.	1	583·9130	583·91300	379·94***
Heterogeneity	78	119·8767	1·53687	....

Conclusions.

The Gusathion and oil treatment was associated with a significantly higher proportion of dead scale than either the Diazinon or control treatments and both positive treatments were better than the nil treatments in this regard.

As for the total numbers of scale associated with each treatment, an $\sqrt{x \times \frac{1}{2}}$ transformation was carried out and an Analysis of Variance performed.

As indicated the total numbers of scale associated with the nil treatment was significantly higher than that associated with either the Diazinon of Gusathion treatments. The numbers of scales associated with the latter two treatments were not significantly different.

Discussion.

The high degree of mortality associated with the above treatments, particularly the Gusathion and oil treatment, illustrates the possibility of achieving commercial control of San José Scale with a post-harvest spray. At this time of the year the scale is mostly of an immature nature and very susceptible to insecticidal treatment. Without further experimental work general spraying during the post-harvest period cannot be recommended at this stage, but the value of treating isolated trees or limited areas known to be infested, is obvious.

Summary.

1. Some observations have been made on the life cycle and habits of San José Scale under West Australian conditions. Five generations may occur, but this is subject to climatic variation.

2. Large scale field trials of dormant sprays, viz., lime-sulphur followed by Superior dormant oil, have shown that while these materials give good control of scale, they are not sufficiently effective to meet the recently imposed phyto-sanitary export requirements.

3. Post-harvest sprays have been shown to cause a large reduction in the scale population, Gusathion at 0.05 per cent. plus dormant oil at 3 gallons to 100 gallons, being more effective than Diazinon at 0.05 per cent. plus dormant oil at 3 gallons to 100 gallons.

4. Summer treatments of Parathion, Gusathion and Diazinon at 0.05 per cent. plus a summer spraying oil, have been demonstrated to be more effective than the previously recommended Malathion which was shown to have exerted a considerable degree of control.

DISCUSSION

The efficiency of Parathion, Gusathion and Diazinon as summer controls and Gusathion and Diazinon as post-harvest sprays has been clearly demonstrated. The Gusathion and Superior oil treatment in the post-harvest spraying experiment gave a 95 per cent. kill of scale present. The conditions existing at post-harvest spraying are closely akin to those experienced during the normal dormant spraying schedule.

It is reasonable to assume that the efficiency of dormant oil spray would be greatly enhanced by the addition of Parathion, Gusathion or Diazinon at a 0.05 per cent. concentration.

Spray equipment must be in first class condition and adequate coverage of trees obtained. This may involve the use of long lances and the removal of loose bark from the butts of trees.

Where concentrate sprayers are used, particular attention should be paid to observe the recommended speed of travel. In this case the trees at the ends of each row should be paid careful attention, as these are often incompletely sprayed, due to an early cut-off.

CONTROL RECOMMENDATIONS

APPLES AND PEARS

Dormant Treatments.

Superior Oil.—Three gallons to 100 gallons water. The efficiency of the dormant oil spray will be increased by adding Gusathion, Diazinon or Parathion as recommended for summer treatments.

—*or*—

Lime-Sulphur.—Ten gallons to 100 gallons water. Applications to be made in late August or early September. When the oil spray is used this should approximate as close as possible to a fortnight prior to bud burst.

Where infestation is severe, two sprayings are required as follows:—

Lime-sulphur during August, followed approximately one month later with Superior oil. The final spraying to be completed by the first week in September.

Summer Treatments.

In the case of severe scale infestation one or more summer treatments may be necessary and the following are recommended:—

Superior Summer oil or white oil 1¼ gallons to 100 gallons water. Plus Gusathion 25 per cent. wettable powder 2 lb. to 100 gallons.

—*or*—

Diazinon 20 per cent. concentrate two pints per 100 gallons.

—*or*—

Parathion 20 per cent. concentrate two pints per 100 gallons.

(The above materials have been found superior to 1¼ pints 5 per cent. Malathion to 100 gallons.)

Application times—

Late November to early December.
Mid-January.
Late February.

STONE FRUITS

Winter.—Lime Sulphur or Superior oil prior to budburst as recommended for apples and pears.

Summer.—As for apples.

N.B.—Parathion is a highly dangerous material and all safety precautions recommended by the manufacturers should be carefully followed. Application of Parathion should not be made within four weeks of harvesting; Gusathion within three weeks and Diazinon within two weeks

or harvesting. When using Gusathion or Diazinon the precautions prescribed for the use of organic insecticides must be observed. Concentrate should not be allowed to come in contact with the skin and protective clothing must be worn at all times while spraying.

ACKNOWLEDGMENTS

The author wishes to thank the Government Entomologist, Mr. C. F. H. Jenkins, for help and advice received while this work was being carried out.

The author also wishes to record his appreciation of the willing co-operation received from Mr. W. G. Jones, Bridgetown, Mr. D. Gwynne, Roleystone and Mr. G. Neaves, Carilla, who made their orchards and equipment available for experimental work.

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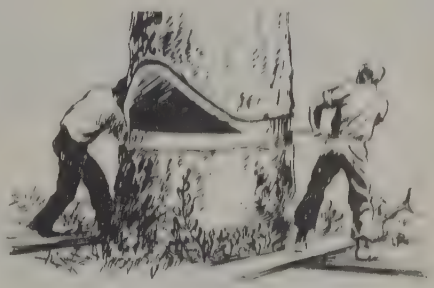

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RAISIN CREAM BEAUTIFUL

Pastry case . . .

1 egg.
2-oz. sugar.
3-oz. shortening.
5-oz. flour.
½ teaspoon baking powder.
Pinch salt.

Raisin cream . . .

2 eggs (yolks and whites separated).
¼ cup brown sugar.
1 tablespoon melted butter.
1 cup chopped seeded raisins.
½ cup cream.
1 teaspoon vinegar.
Little cinnamon.
Salt to taste.

To make pastry shell: Beat 1 egg and sugar together. Cut shortening into egg mixture. Sift flour, baking powder and pinch salt and work into creamed mixture. Turn on to floured board, roll out, spread on to pie plate. Leave a little pastry to make strips across plate.

Raisin cream filling: Combine yolks of eggs with brown sugar, melted butter. Add raisins, cream, vinegar, cinnamon and salt to taste. Mix well. Beat egg whites until stiff, fold into mixture. Pour into the uncooked pie shell and lattice across with strips of pastry. Bake in a hot oven for 10 minutes, reduce heat and cook for another 15 minutes. Serve with whipped cream.

LIST OF REGISTERED STOCK FOODS AND STOCK LICKS, 1959-60

(By H. G. CARISS, Inspector of Feeding Stuffs)

All foods for stock sold in Western Australia are required by the Feeding Stuffs Act, 1928-1951, to be registered annually with the Department of Agriculture. For the purposes of the Act, "Foods for Stock" includes stock licks, which in turn embrace all preparations claimed to supply or primarily intended to supply mineral matter to stock.

The registration year for stock foods commences on July 1 each year. When making application for registration, manufacturers must submit a guaranteed analysis for each of their products, together with a list of ingredients used in each stock food. Regular inspection and sampling is carried out by officers of the Department to see that stock foods comply with the registered analysis.

Sellers of stock foods are required by the Feeding Stuffs Act, to ensure that to each package is clearly and conspicuously attached a label or brand showing the name and place of business of the manufacturer or importer, the registered brand and name of the food or lick and the registered analysis.

A list of stock foods and stock licks which have been registered for the current registration year appears overleaf.

Before purchasing any food or lick, buyers are advised to consult the list of registered stock foods and stock licks from which a comparison of foods or licks of similar types can be made and also to ensure that packages are correctly labelled. If any doubts arise, inquiries should be made at the Department of Agriculture, where information concerning the provisions and requirements of the Feeding Stuffs Act, and advice on other aspects of stock feeding can be obtained.

Stock Food	Applic. No.	Brand	By whom registered	Materials from which made	Registered Analysis: Crude Protein	Crude Fat	Crude Fibre	Sodium Chloride ($NaCl$)	Phosphoric Acid (P_2O_5)	Calcium (Ca)	Percentages of other substances claimed to be of reputed Medicinal or Nutritive Value
					(Min.) %	(Max.) (Min.) %	(Max.) %	(Max.) (Min.) %	(Max.) (Min.) %	(Max.) (Min.) %	%
A.—Simple Foods											
1.—Meat Meals											
Meat Meal	5	N.Z.	Burridge & Warren Pty. Ltd.	Animal blood and bone	47·0	8·0	1·6	0·46	....	11·4*	
Do.	24	Watsonia	Watsons Foods Pty. Ltd.	Abattoir offal	27·0	19·7 17·7	1·5	....	17·3 15·3	15·5 13·5	
Do.	28	Coogee	Anchorage Butchers Pty. Ltd.	Waste meal products	36·0	18·0	2·0	1·0 *Nil*	12·5 9·0	12·5 8·0	
Do.	42	Midland	Midland Junction Abattoirs	Abattoir offal	50·0	15·0 12·0	2·0				
Do.	43	Star Brand	Fergusons Pty. Ltd. ...	Green bone, blood and cracknel	50·0	12·0	2·0				
Do.	83	W.A.M.E.	W.A. Meat Export Works	Meat and bone	50·0	13·0	2·0	2·0 *Nil*	12·0 7·0	11·0 6·0	
Do.	149	Waruna	Waroona Abattoirs	Abattoir offal	50·0	14·0	2·0	1·0 *Nil*	13·5 9·5	10·0 8·0	
2.—Bone and Meat Meals											
Bone and Meat Meal	44	Mars Brand	Fergusons Pty. Ltd.	Green bone	37·0	12·0 9·0	2·0	....	15·0		
Do. do.	45	Apex	do. do.	do.	37·0	12·0 9·0	2·0	....	15·0		
Feeding Meat and Bone Meal	55	Mercury	H. C. Sleigh Ltd.	Animal meat and bone	45·0	13·0 11·0	1·5	0·6 0·5	20·0 17·1	13·0 11·3	
Meat and Bone Meal	57	T.B. & S.	T. Borthwick & Sons Ltd.	Animal offals	45·0	20·0	4·0	....	10·0 8·0	6·0*	
Do. do.	78	A.J.B.	A. J. Bush & Sons Pty. Ltd.	Meats, bones, fats, offals	45·0	11·0 8·0	2·0	0·2 0·1	18·0 12·0		
3.—Whale Meal											
Whale Meal	14	N.W.W.	Nor-West Whaling Co. Ltd.	Humpback whales	66·0	5·0	1·0	1·5 0·5	10·0 7·0	11·0 8·0	
Whale Meal 64%	15	do.	do. do. do.	do.	64·0	5·0	1·0	1·0 0·5	10·0 7·0	11·0 8·0	
Whale Meal "A"	26	Cheynes Beach	Cheynes Beach Whaling Co. Ltd.	Whale meat and bones	62·0	6·0 4·0	5·0	2·5 1·0	16·0 14·0	15·0 13·0	
Whale Meal "B"	27	do.	do. do. do.	do. do.	56·0	6·0 4·0	5·0	2·5 1·0	16·0 14·0	15·0 13·0	
4.—Whale Solubles											
Whale Solubles	16	N.W.W.	Nor-West Whaling Co. Ltd.	Humpback whales	82·0	0·4	0·1	2·5 0·5	1·5 1·0	1·5 1·0	
Dried Whale Solubles 79%	17	do.	do. do. do.	Baleen whales	79·0	0·4	0·1	2·5 0·5	1·5 1·0	1·5 1·0	
Liquid Whale Solubles	81	do.	do. do. do.	Whales	35·0	....	....	1·0 0·75	2·0 0·5	0·75 0·25	
5.—Fish Meals											
Crayfish Meal	6	Golden Gleam	Golden Gleam Fish Processing Co. Ltd.	Crayfish offal	40·0	8·0	....	4·5 3·0	3·0 1·0	11·0 7·0	
Cray Meal	29	Ancho	Anchorage Butchers Pty. Ltd.	Waste crayfish products	36·0	12·0 9·0	10·0	3·5 2·5	7·0 4·0	14·0 11·0	
6.—Milk Foods											
Skim Milk Powder	54	Watsonia	The Capel Dairy Co. Pty. Ltd.	Skim milk	32·6	0·75	....	1·98	2·09*	1·26*	

Do. do.	79	Peters	Peters Creameries (W.A.) Pty. Ltd.	do.	35·3	0·25*	1·0	1·75	2·41	1·29	Lactose 55·0
Dried Skim Milk Powder	126	Sunny West	Sunny West Co-op. Dairies Ltd.	Liquid milk	34·0	2·0 *Nil*	0·5	2·0 1·0	3·0 2·0	2·0 1·0	Lactose Min. 48·0
Dried Buttermilk Powder	127	do.	do. do. do.	Buttermilk	29·0	11·0 2·0	0·5	3·0 1·0	2·5 1·5	1·5 0·5	Ash 43·9 Carbohydrates 43·9
Protein Feed Supplement	239	Nutro-Myo	Page Boy Products (W.A.)	Based on milk, sugar and skim milk powder	27·5	5·4	11·7	....	2·8*	4·8*	Riboflavin 18·0 mg./lb. Thiamine 19·0 mg./lb. B12 40·0 mg./lb. Niacin 90·0 mg./lb.
7.—Yeast Products											
Brewers Dried Yeast	12	B.D.	Ken McGibbon & Co.	Brewery yeast	45·0	....	1·5	....	....	13·0 11·0	
8.—Wheat Products											
Wheat Meal	53	Millers	W. H. Milne & Co. Pty. Ltd.	Wheat	8·0	....	5·0				
Do.	94	"C" Meal	W. Thomas & Co. (W.A.) Ltd.	do.	8·0	....	10·0				
9.—Oil Seed Meals											
Linseed Oil Meal	59	M.L.M.	Elder Smith & Co. Ltd.	Linseed	35·0	6·0 3·5	10·0				
30% Linseed Oil Meal Sheep Nuts	96	Thomas	W. Thomas & Co. (W.A.) Ltd.	Pure linseed oil meal	30·0	3·0	12·0				
Pure Linseed Sheep Cubes	197	Wesfarmers....	Westralian Farmers Co-op. Ltd.	Linseed meal, molasses	35·0	6·0 3·0	12·0	....	2·0 0·5	2·0 0·5	
Linseed Oil Meal	231	Hemphill Grays	Hemphill Gray Oil Mills Pty. Ltd.	Linseed	28·0	12·0 6·0	12·0				
Rape Meal	232	do.	do. do. do.	Rape seed	30·0	10·0 5·0	13·0				
10.—Molasses Products.											
Proteinised Molasses Block	80	Molactrate	Wm. Haughton & Co. Ltd.	Magnesium, sulphur, phosphate, meat extractive for animal proteins, whey extract, calcium, cane molasses, potassium, sodium, chloride, cobalt, iodine, copper	17·5	3·0 *Nil*	*Nil*	5·5 4·0	4·5 2·0	4·5 2·0	Ash 14·4% Sugar 44·6% Potassium Max. 6·0% Min. 3·0% Copper Max. 6 ppm Min. 4 ppm Cobalt Max. 3 ppm Min. 2 ppm
Molasapol	88	Mayco	Maylands Milling Co. Pty. Ltd.	Molasses, bran, pollard	7·5	3·0 2·0	4·0	*Nil*	1·0 0·5	1·0 0·4	
Dried Concentrate with Molasses	238	Drimolas	Page Boy Products (W.A.)	Blackstrap cane molasses and stabiliser (coconut meal)	10·6	5·5 2·0	6·6	0·5	....	....	Sugars ⎫ Nitrogen free Starches ⎭ extract 66·5
B.—Compound Foods.											
1.—Cattle Foods.											
Sweet Dairy Feed	74	Brownes	Brownes Dairy Ltd.	Bran, pollard, grain meals, urea, phosphate, molasses, lime, salt, calcium, cobalt, iodine, brewer's grain	16·0	5·82 5·0	14·9	2·0 1·0	2·5 1·0	4·0 1·0	
16% Protein Sweet Dairy Nuts	105	Thomas	W. Thomas & Co. (W.A.) Ltd.	Bran, pollard, gristed grains, malt combings, tech urea, molasses, oyster flour, salt, manganese sulphate, stabilised iodine, cobalt sulphate, Christmas phosphate	16·0	1·5*	10·0	2·0 1·0	2·5 1·0	4·0 1·0	Manganese 60·0 ppm Iodine 1·2 ppm Cobalt 3·0 ppm
32% Dairy Cake Concentrate	106	do.	do. do. do.	Linseed meal and/or peanut meal, coconut meal, whale meal, tech urea, pollard, oyster flour, sodium chloride, manganese sulphate, Christmas phosphate, stabilised iodine, cobalt	32·0	1·5*	5·0	5·0 2·0	8·5 3·5	9·0 4·0	Manganese 60·0 ppm Iodine 10·2 ppm Cobalt 30·0 ppm
20% Protein Sweet Dairy Food	108	do.	do. do. do.	Bran, pollard, gristed grains, malt combings, tech urea, molasses, oyster flour, salt, manganese sulphate, stabilised iodine, cobalt sulphate, Christmas phosphate	20·0	1·5*	10·0	2·0 1·0	2·5 1·0	4·0 1·0	Manganese 60·0 ppm Iodine 1·2 ppm Cobalt 3·0 ppm

* Minimum.

Stock Food	Applic. No.	Brand	By whom registered	Materials from which made	Registered Analysis						Percentages of other substances claimed to be of reputed Medicinal or Nutritive Value
					Crude Protein	Crude Fat	Crude Fibre	Sodium Chloride (NaCl)	Phosphoric Acid (P_2O_5)	Calcium (Ca)	
					(Min.) %	(Max.) (Min.) %	(Max.) %	(Max.) (Min.) %	(Max.) (Min.) %	(Max.) (Min.) %	%
B.—Compound Foods—*continued*											
1.—*Cattle Foods—contd.*											
16% Protein Sweet Dairy Food	109	Thomas	W. Thomas & Co. (W.A.) Ltd.	Bran, pollard, gristed grains, malt combings, tech urea, molasses, oyster flour, salt, manganese sulphate, stabilised iodine, cobalt sulphate, Christmas phosphate	16·0	1·5*	10·0	2·0 1·0	2·5 1·0	4·0 1·0	Cobalt 3·0 ppm
11% Sweetened Dairy Meal	189	Wesfarmers ...	Westralian Farmers Co-op. Ltd.	Bran, pollard, oat meal, meat meal, bone meal, salt, limestone, molasses, barley meal, ground phosphate rock	11·0	5·0 2·5	10·0	2·0 0·5	2·0 1·0	2·5 2·0	Copper (Cu) trace Cobalt (Co) trace
11% Protein Sweet Dairy Food	110	Thomas	W. Thomas & Co. (W.A.) Ltd.	Bran, pollard, gristed grains, malt combings, molasses, oyster flour, salt, manganese sulphate, stabilised iodine, cobalt, Christmas phosphate	11·0	1·5*	10·0	2·0 1·0	2·5 1·0	4·0 1·0	Manganese 60·0 ppm Iodine 1·2 ppm Cobalt 3·0 ppm
16% Sweetened Dairy Meal	190	Wesfarmers....	Westralian Farmers Co-op. Ltd.	Bran, pollard, wheat germ, linseed, oat meal, molasses, barley, meat and bone meals, rolled wheat, limestone, salt, ground phosphate rock	16·0	5·0 2·5	10·0	3·5 2·0	3·5 2·3	2·5 2·0	
20% Sweet Dairy Meal	191	do.	do. do. do.	Bran, pollard, meat meal, molasses, oat meal, salt, ground phosphate rock	20·0	5·0 2·5	10·0	2·0 0·5	2·0 1·0	3·0 2·0	
Cattle Food	216	Evelyn	Tropical Traders & Patersons Ltd.	Gristed wheat, barley, rye, pollard, salt, limestone, chalk, animal charcoal, molasses, sulphur, sulphate iron, copper sulphate	5·0	2·0 1·0	5·5	13·0 12·0	4·25 3·25	9·5 8·5	Sulphur 3·6
2.—*Calf Foods.*											
Calf Food	13	Harper's Star	Robert Harper & Co. Ltd.	Wheat, oats, rice, barley, linseed, mustard, branning, whiting, salt, peas and condiments	12·0	2·5*	10·0	2·0 1·0	2·5 1·0	1·0 0·25	
20% Protein Vitamised Antibiotic Calf Food	107	Thomas	W. Thomas & Co. (W.A.) Ltd.	Linseed meal, coconut meal, pollard, salt, Christmas phosphate, oyster flour, manganese sulphate, stabilised iodine, cobalt sulphate, stabilised vitamins A and D_3, procaine penicillin	20·0	2·5*	8·0	3·0 0·5	2·5 0·2	2·5 0·5	Vitamin A 6,000,000 I.U./ton Vitamin D_3 1,800,000 I.U./ton Manganese 60·0 ppm Cobalt 3·0 ppm Stab. Iodine 1·2 ppm
Calf Meal "A-B" (A and D_3)	188	Wesfarmers....	Westralian Farmers Co-op. Ltd.	Pollard, buttermilk, linseed meal, dried yeast, wheat meal, limestone, bone meal, antibiotics and stabilised vitamins A and D_3	20·0	5·0 3·0	3·0	2·0 0·5	2·3 1·5	1·5 1·0	Vitamin A 2,000 I.U./lb. Vitamin D_3 150 I.U./lb.
Calf Food	214	Eve-Lyn	Tropical Traders & Patersons Ltd.	Gristed wheat, barley, rye, pollard, linseed, salt, sugar, chalk, tumeric, sodium bi-carbonate, cream of tartar, foenugreek, coriander, copper sulphate, bole armenian	8·5	2·0	3·86	3·5 2·5	1·25 0·25	1·0 0·2	Carbohydrates 66·45 Sulphur (Max.) 1·75
Calf Food	220	Western	David Gray & Co. Ltd.	Malt grains, milk powder, yeast, whale solubles, pollard, wheat cereals, trace elements	16·0	6·0*	7·5	1·5 0·5	1·5 0·5	1·0 0·15	

3.—Sheep Foods											
21% Protein Vitamised Ewe, Lamb and Breeders Nuts	97	Thomas	W. Thomas & Co. (W.A.) Ltd.	Peanut meal, linseed, meal, bran, pollard, tech urea, grain meals, molasses, oyster flour, salt, vitamins A and D_3, Christmas phosphate	21·0	2·0*	11·5	4·0 2·0	3·0 1·0	4·0 2·0	Manganese 60·0 ppm Cobalt 3·0 ppm Stab. Iodine 1·2 ppm Vitamin A 6,000,000 I.U./ton Vitamin D_3 1,800,000 I.U./ton
11% Protein Vitamised Maintenance Sheep Nuts	98	do.	do. do. do.	Bran, pollard, grain meals, molasses, salt, oyster flour, vitamins A and D_3, Christmas phosphate	11·0	1·0*	15·0	2·0 1·0	2·0 0·5	3·5 1·5	do. do.
Maintenance Sheep Cubes	194	Wesfarmers....	Westralian Farmers Co-op. Ltd.	Bran, pollard, wheat meal, wheat germ, salt, meat meal, limestone, cobalt, copper, urea	14·0	4·0 3·0	6·5	3·5 2·0	3·5 2·3	2·5 2·0	Copper (Cu) trace Cobalt (Co) trace
Sheep Breeder Cubes	195	do.	do. do. do.	Bran, pollard, wheat meal, wheat germ, linseed, meat meal, limestone, salt, cobalt, copper, urea	18·0	4·0 3·0	7·5	3·5 2·0	4·5 3·5	2·5 2·0	Copper (Cu) trace Cobalt (Co) trace
30% Protein Linseed Sheep Cubes	196	do.	do. do. do.	Linseed meal, pollard, molasses	30·0	6·0 3·0	12·0	*Nil*	2·0 0·5	2·0 0·5	
Sheep Food	217	Eve-Lyn	Tropical Traders & Patersons Ltd.	Gristed wheat, barley, rye, pollard, salt, limestone, chalk, sulphur, animal charcoal, molasses, sulphate of iron, copper sulphate, medicinal herbs	5·0	2·0 1·0	5·0	13·5 12·5	4·0 3·5	9·6 8·6	Sulphur (Max.) 2·75
"Solids" for Sheep	221	Min-a-Vit	Min-a-Vit Pty. Ltd.	Coconut meal, wheat germ, meat meal, malt combings, crushed wheat and min-a-vit	14·0	3·0*	6·0	1·6	5·24*	(CaO) 10·8	(Mgo) 0·92 Vitamin D_3 105 I.U./grm.
"Solids Plus" for Sheep	222	do.	do. do.	do. do. do.	14·0	3·0*	6·0	1·6	5·24*	(CaO) 10·8	(Mgo) 0·92 Vitamin A 158 I.U./grm. Vitamin D_3 105 I.U./grm.
Ewe and Lamb Sheep Nuts	233	Western	Hemphill Gray Oil Mills Pty. Ltd.	Linseed oil meal, rape meal, gristed grains, bran, pollard, molasses, urea, salt, calcium phosphorus, cobalt sulphate	21·0	2·0*	11·5	5·0 2·0	4·0 2·0	3·0 1·0	Cobalt trace
4.—Poultry Foods											
Laying Mash No. 1	9	Wrights	Wrights Ltd.	Bran, pollard, wheat meal, meat meal, salt, whale meal, bone meal, gristed oats, oyster flour	16·0	6·0 3·0	6·0	1·5 0·75	3·0 1·0	3·5 1·0	
Vitamins A and D_3 Fortified Laying Mash No. 1	10	do.	do.	Bran, pollard, wheat meal, meat meal, salt, whale meal, bone meal, gristed oats, oyster flour, vitamins A and D_3	16·0	6·0 3·0	6·0	1·5 0·75	3·0 1·0	3·5 1·0	Vitamin A 6,000,000 I.U./ton Vitamin D_3 600,000 I.U./ton
Laying Mash No. 1	50	Millers	W. H. Milne & Co. Pty. Ltd.	Bran, pollard, wheat meal, whale meal, salt, meat meal, gristed oats, oyster flour, ground rock phosphate, manganese sulphate	16·0	6·0 3·0	6·0	1·5 0·75	3·0 1·0	3·5 1·0	
16% Laying Mash Vitamins A and D_3 Fortified	51	do.	do. do. do.	do. do. do. plus vitamins A and D_3	16·0	6·0 3·0	6·0	1·5 0·75	3·0 1·0	3·5 1·0	do. do.
Fattening Mash	52	do.	do. do. do.	Bran, pollard, gristed oats, meat meal, wheat meal, salt, limestone	13·0	6·0 3·0	6·0	1·5 0·75	3·0 1·0	3·5 1·0	
Laying Mash (A and D_3)	64	Apex	E. J. Fry Pty. Ltd.	Wheat meal, bran, pollard, meat meal, bone meal, oyster flour, whale meal, vitamins A and D_3	16·0	3·0*	6·0	1·0 0·25	3·0 1·1	3·0 2·0	Vitamin A 3,000 I.U./lb. Vitamin D_3 300 I.U./lb.
Laying Mash	65	do.	do. do.	Wheat meal, bran, pollard, meat meal, bone meal, oyster flour, whale meal	16·0	3·0*	6·0	1·0 0·25	3·0 1·1	3·0 2·0	
Laying Mash	66	Symonds	E. Symonds	Bran, pollard, gristed grains, wheat germ, whale meal, meat meal, blood meal, dried solubles, oyster flour, manganese sulphate, Christmas phosphate	16·0	2·5*	6·0	2·0 0·25	3·5 1·0	3·75 1·0	

* Minimum.

Stock Food	Applic. No.	Brand	By whom registered	Materials from which made	Registered Analysis						Percentages of other substances claimed to be of reputed Medicinal or Nutritive Value
					Crude Protein	Crude Fat	Crude Fibre	Sodium Chloride (NaCl)	Phosphoric Acid (P_2O_5)	Calcium (Ca)	
					(Min.) %	(Max.) (Min.) %	(Max.) %	(Max.) (Min.) %	(Max.) (Min.) %	(Max.) (Min.) %	%
B.—Compound Foods—*continued*											
4.—*Poultry Foods—cld.*											
Laying Pellets	69	Symonds	E. Symonds	Bran, pollard, gristed grains, wheat germ, whale meal, meat meal, blood meal, dried solubles, oyster flour, manganese sulphate, Christmas phosphate	16·0	2·5*	6·0	2·0 0·25	3·5 1·0	3·75 1·0	
Egglayer A and D_3	75	Barrow Linton Pty. Ltd.	Barrow Linton Pty. Ltd.	Bran, pollard, rolled wheat, gristed oats, meat meal or whale solubles, bone meal, oyster flour, stabilised vitamins A and D_3	16·0	6·0 4·0	7·0	1·0 *Nil*	3·5 2·3	2·5 2·0	Vitamin A 3,300 I.U./lb. Vitamin D_3 450 AOAC chick units per lb.
Special Laying Mash	84	Mayco	Maylands Milling Co. Pty. Ltd.	Bran, pollard, meat meal, wheat meal, bone meal, shellgrit, salt	17·0	4·0 3·5	5·0	1·0 0·75	3·0 2·5	3·5 3·0	
Laying Mash	85	do.	do. do. do.	do. do. do.	16·0	4·0 3·5	5·0	1·0 0·75	3·0 2·5	3·5 3·0	
Laying Mash	90	Parsons	Parsons Pty. Ltd.	Bran, pollard, gristed grain, wheat germ, whale meal, meat meal, blood meal, dried solubles, oyster flour, manganese sulphate, Christmas phosphate	16·0	2·5*	6·0	2·0 *Nil*	3·50 *Nil*	3·75 *Nil*	
40% Vitamised Universal Poultry Concentrated	111	Thomas	W. Thomas & Co. (W.A.) Ltd.	Whale meal and/or meat meal and/or fish meal, oyster flour, manganese sulphate, Vitamin A and D_3, Riboflavin, trace minerals, Christmas phosphate	40·0	9·0	1·5	0·4 0·2	12·5 8·5	20·5 18·5	Vitamin A 40,000,000 I.U./ton Vitamin D_3 4,000,000 I.U./ton Vitamin B_{12} Micrograms per gram
19% Breeders Pellets	112	do.	do. do. do.	Bran, Pollard, wheat meal, barley, whale and meat meal, skim milk powder, brewers yeast, Christmas phosphate, oyster flour, salt, manganese sulphate, riboflavin, stabilised vitamins A and D_3	19·0	2·5*	6·0	1·0 0·5	3·75 1·0	3·75 1·0	Vitamin A 6,000,000 I.U./ton Vitamin D_3 1,000,000 I.U./ton
18% Protein Vitamised Cockerel Fattening Pellets	113	do.	do. do. do.	Bran, pollard, gristed grains, wheatgerm, whale and/or meat meal, oyster flour, vitamins A and D_3, Christmas phosphate, manganese sulphate, blood meal	18·0	2·0*	6·5	1·0 0·5	3·5 1·0	3·75 1·0	Vitamin A 6,000,000 I.U./ton Vitamin D_3 1,800,000 I.U./ton
20% Protein Antibiotic Vitamised Broiler Crumbles with Nicrazin	114	do.	do. do. do.	Bran, pollard, cereal meals, wheatgerm, meat meal, and/or whale meal, and/or dried solubles, oyster flour, riboflavin, procaine, penicillin, vitamins A and D_3, nicarbazine (nicrazin), Christmas phosphate, lucerne pollard, manganese sulphate, milk powder	20·0	2·5*	6·0	1·0 0·25	3·0 1·0	2·5 1·0	Vitamin A 5,000,000 I.U./ton Vitamin D_3 1,500,000 I.U./ton
20% Protein Vitamised Laying Pellets	118	do.	do. do. do.	Bran, pollard, gristed grains, wheatgerm, whale meal, dried solubles and/or meat meal, oyster flour, vitamins A and D_3, Christmas phosphate, manganese sulphate, lucerne meal	20·0	2·5*	6·0	2·0 0·5	7·0 2·0	7·5 2·0	Vitamin A 12,000,000 I.U./ton Vitamin D_3 3,600,000 I.U./ton
20% Protein Laying Pellets	119	do.	do. do. do.	do. do. do. minus vitamins A and D_3	20·0	2·5*	6·0	2·0 0·5	7·0 2·0	7·5 2·0	

15% Protein Vitamised Laying Pellets No. 1	120	do.	do.	do.	do.	do. do. do. plus vitamins A and D_3	16·0	2·5*	6·0	1·0 0·25	3·5 1·0	3·75 1·0	Vitamin A 6,000,000 I.U./ton Vitamin D_3 1,800,000 I.U./ton
16% Protein Laying Pellets No. 1	121	do.	do.	do.	do.	do. do. do. minus vitamins A and D_3	16·0	2·5*	6·0	1·0 0·25	3·5 1·0	3·75 1·0	
19% Beeders Mash	123	do.	do.	do.	do.	Bran, pollard, wheat and barley meal, whale and meat meal, skim milk powder, brewers yeast, Christmas phosphate and/or bone flour, oyster flour, sodium chloride, manganese sulphate, riboflavin vitamins A and D_3	19·0	2·5*	6·0	1·0 0·15	3·75 1·0	3·75 1·0	Vitamin A 6,000,000 I.U./ton Vitamin D_3 1,800,000 I.U./ton
18% Protein Vitamised Cockerel Fattening Mash	124	do.	do.	do.	do.	Bran, pollard, gristed grains, wheatgerm, whale and/or meat meal, blood meal, oyster flour, vitamins A and D_3, Christmas phosphate, manganese sulphate	18·0	2·0*	6·5	1·0 0·5	3·5 1·0	3·75 1·0	do. do. do.
H.P. Laying Mash 20% Protein Vitamin (A and D_3) Fortified	132	Morlay	R. B. Young Products Pty. Ltd.			Wheat meal, bran, pollard, meat, whale and bone meals, whale solubles, oyster flour, rock phosphate, minerals, "Apac"	20·0	3·0*	5·5	2·0 0·25	3·0 1·0	4·0 1·5	Vitamin A 3,300 I.U./lb. Vitamin D_3 300 I.U./lb.
Laying Mash Vitamin Fortified (A and D_3)	133	do.	do.	do.	do.	do. do. do.	16·0	3·0*	5·5	2·0 0·25	3·0 1·0	4·0 1·5	do. do. do.
Laying Mash	134	do. ..	do.	do.	do.	do. do. do. minus "Apac"	16·0	3·0*	5·5	2·0 0·25	3·0 1·0	4·0 1·5	
D-Mash (Fattening)	139	do.	do.	do.	do.	Wheat meal, bran, pollard, whale and meat meal, minerals	11·0	3·0*	5·5	2·0 0·25	3·0 1·0	4·0 1·5	
20% Protein Vitamised Laying Mash	144	Thomas	W. Thomas & Co. (W.A.) Ltd.			Bran, pollard, gristed grains, wheat germ, whalemeal, dried solubles and/or meat meal, salt, oyster flour, vitamins A and D_3, manganese sulphate, Christmas phosphate, lucerne meal	20·0	2·5*	6·0	2·0 0·5	7·0 2·0	7·5 2·0	Vitamin A 12,000,000 I.U./ton Vitamin D_3 3,600,000 I.U./ton
20% Protein Laying Mash	145	do.	do.	do.	do.	do. do. do. minus vitamins A and D_3	20·0	2·5*	6·0	2·0 0·5	7·0 2·0	7·5 2·0	
16% Protein Vitamised Laying Mash No. 1	146	do.	do.	do.	do.	do. do. do. plus vitamins A and D_3	16·0	2·5*	6·0	1·0 0·25	3·5 1·0	3·75 1·0	Vitamin A 6,000,000 I.U./ton Vitamin D_3 1,800,000 I.U./ton
16% Protein Laying Mash No. 1	147	do.	do.	do.	do.	do. do. do. minus vitamins A and D_3	16·0	2·5*	6·0	1·0 0·25	3·5 1·0	3·75 1·0	
Laying Mash	148	Gardners	Gardner Bros. Pty. Ltd.			Bran, pollard, wheatmeal, gristed oats, oyster flour, salt, whale meal, meat meal, bone meal	16·0	6·0 3·0	6·0	1·5 0·75	3·0 1·0	3·5 1·0	
Laying Pellets	157	Wesfarmers....	Westralian Farmers Co-op. Ltd.			Bran, pollard, wheat meal, oat meal, meat meal, bone meal, oyster flour	16·0	6·0 4·0	7·0	1·0 *Nil*	3·5 2·3	2·5 2·3	
All Mash Pellets	158	Red Comb	do.	do.	do.	do. do. do.	16·0	6·0 4·0	7·0	1·0 *Nil*	3·5 2·3	2·5 2·0	
All Mash Pellets A and D_3	159	do.	do.	do.	do.	do. do. do. plus vitamins A and D_3	16·0	6·0 4·0	7·0	1·0 *Nil*	3·5 2·3	2·5 2·0	Vitamin A 3,300 I.U./lb. Vitamin D_3 450 AOAC Chick Units/lb.
Hi-Protein Pellets A and D_3	160	do.	do.	do.	do.	Bran, pollard, wheat meal, meat meal, whale and bone meal, shell dust, stabilised vitamins A and D_3	20·0	10·0 6·0	8·0	0·5 0·1	5·0 4·0	2·5 1·5	Vitamin A 6,640 I.U./lb. Vitamin D_3 900 Chick Units/lb.
Poultry Breeders Pellets A and D_3	161	do.	do.	do.	do.	Bran, pollard, wheat meal, whale and meat meals, buttermilk, brewer's yeast, bone meal, oyster flour, manganese sulphate, lucerne meal, wheat germ, vitamins A and D_3, riboflavin	18·0	7·0 5·0	7·0	2·0 *Nil*	4·0 2·0	2·5 1·0	Vitamin A 3,400 I.U./lb. Vitamin D_3 350 I.U./lb.

* Minimum.

STOCK FOODS—continued

Stock Food	Applic. No.	Brand	By whom registered	Materials from which made	Registered Analysis						
					Crude Protein	Crude Fat	Crude Fibre	Sodium Chloride (NaCl)	Phosphoric Acid (P_2O_5)	Calcium (Ca)	Percentages of other substances claimed to be of reputed Medicinal or Nutritive Value
					(Min.) %	(Max.) (Min.) %	(Max.) %	(Max.) (Min.) %	(Max.) (Min.) %	(Max.) (Min.) %	%
B.—Compound Foods—*continued*											
4.—*Poultry Foods—ctd.*											
Deworming Pellets	162	Red Comb	Westralian Farmers Co-op. Ltd.	Bran, pollard, wheat meal, meat meal, piperazine adipate	14·0	7·0 5·0	7·0	2·0 0·5	2·0 0·1	2·0 0·1	Piperazine adipate 0·3%
Laying Mash	171	Wesfarmers....	do. do. do.	Bran, pollard, rolled wheat, gristed oats, meat meal or whale solubles, bone meal, oyster flour	16·0	6·0 4·0	7·0	1·0 *Nil*	3·5 2·3	2·5 2·3	
"P" All Mash	172	do.	do. do. do.	do. do. do.	16·0	6·0 4·0	7·0	1·0 *Nil*	3·5 2·3	2·5 2·0	
"P" All Mash A and D_3	173	do.	do. do. do.	do. do. do. plus vitamins A and D_3	16·0	6·0 4·0	7·0	1·0 *Nil*	3·5 2·3	2·5 2·0	Vitamin A 3,300 I.U./lb. Vitamin D_3 450 Chick Units/lb.
Hi-Protein Mash A and D_3	174	do.	do. do. do.	Bran, pollard, rolled wheat, meat, whale and bone meal, shell dust, stabilised vitamins A and D_3	20·0	10·0 6·0	8·0	0·5 0·1	5·0 4·0	2·5 1·5	Vitamin A 6,640 I.U./lb. Vitamin D_3 900 Chick Units/lb.
Poultry Breeders Mash A and D_3	175	do.	do. do. do.	Bran, pollard, wheat, whale, meat and bone meals, oyster flour, buttermilk, brewers yeast, manganese sulphate, lucerne meal, wheat germ, vitamins A and D_3, riboflavin	18·0	7·0 5·0	7·0	2·0 *Nil*	4·0 2·0	2·5 1·0	Vitamin A 3,400 I.U./lb. Vitamin D_3 350 I.U./lb.
Deworming Mash	176	do.	do. do. do.	Bran, pollard, wheat meal, meat meal, piperazine adipate	14·0	7·0 5·0	7·0	2·0 0·5	2·0 0·1	2·0 0·1	Piperazine adipate 0·3%
Special Laying Mash	213	Bairds	Bairds Pty. Ltd.	Bran, pollard, wheat meal, bone meal, oyster flour, salt, meat meal	17·0	4·0 3·5	5·0	1·0 0·75	3·0 2·5	3·5 3·0	
5.—*Chicken Foods.*											
Chick Starter Mash	33	Altona	Altona Hatchery	Bran, pollard, wheat meal, whale and bone meals, wheat germ, oyster flour, manganese sulphate, riboflavin, terramycin, vitamins A and D_3	15·0	4·0 2·0	6·0	1·0 0·15	2·5 1·2	1·5 0·5	Vitamin A 3,000 I.U./lb. Vitamin D_3 300 I.U./lb.
Chick Food	34	H & C	Haynes & Clements	Wheat, maize, peas, grit	9·0	3·0 1·5	4·5	....	....	....	(CaO) 3·0
Chick Starter	48	Millers	W. H. Milne & Co. Pty. Ltd.	Bran, pollard, wheat meal, gristed oats, salt, whale meal, bone flour, brewers yeast, buttermilk, manganese sulphate	16·0	6·0 3·0	6·0	1·5 0·75	3·0 1·0	3·5 1·0	Vitamin A 6,000,000 I.U./ton Vitamin D_3 600,000 I.U./ton
Chick Builder	49	do.	do. do. do.	Bran. pollard, wheat meal, bone, meat and whale meal, gristed oats, salt, oyster flour, manganese sulphate	15·0	6·0 3·0	6·0	1·5 0·75	3·0 1·0	3·5 1·0	do. do.
Chick Starter (A and D_3)	62	Apex	E. J. Fry Pty. Ltd.	Bran, pollard, wheat, meat and bone meals, buttermilk, vitamins A and D_3	17·0	3·0*	6·0	1·0 0·25	2·0 1·1	3·0 1·0	Vitamin A 3,000 I.U./lb. Vitamin D_3 300 I.U./lb.
Growers Mash (A and D_3)	63	do.	do. do.	do. do. do.	15·0	3·0*	6·0	1·0 0·25	2·0 1·1	3·0 1·5	do. do.
Growers Mash	67	Symonds	E. Symonds	Bran, pollard, gristed grains, wheat germ, salt, meat meal, and/or whale meal, and/or dried solubles, oyster flour, vitamins A and D_3, riboflavin, Christmas phosphate, manganese sulphate	15·0	2·5*	6·0	1·25 0·5	3·5 1·0	3·75 0·5	

Chick Starter	68	do.	do.	Bran, pollard, gristed grains, pea meal, meat meal and/or whale meal, oyster flour, riboflavin, procaine, penicillin, vitamins A and D_3, milk powder, manganese sulphate, lucerne pollard, Christmas phosphate and/or bone flour	18·0	2·5*	6·0	1·0 0·25	3·0 1·0	2·5 1·0	
Vitaliser "A" AB A and D_3	76	Barrow Linton Pty. Ltd.	Barrow Linton Pty. Ltd.	Bran, pollard, cracked wheat, oat meal, wheat meal, buttermilk, bone meal, antibiotics, vitamins A and D_3, riboflavin	16·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·3 0·8	Vitamin A 2,000 I.U./lb. Vitamin D_3 180 Chick Units/lb.
Growell A and D_3	77	do.	do. do. do.	Bran, pollard, rolled wheat, oat meal, meat meal, bone meal, stabilised vitamins A and D_3	14·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·5 1·0	do. do.
Special Chick Starter	86	Mayco	Maylands Milling Co. Pty. Ltd.	Bran, pollard, meat meal, wheat meal, bone meal, shell grit, salt, riboflavin, emulsified fish oil	17·0	4·0 3·5	5·0	1·0 0·75	3·0 2·5	3·5 3·0	Manganese sulphate 0·025
Growing Mash	87	do.	do. do. do.	do. do. do.	15·0	4·0 3·5	5·0	1·0 0·75	3·0 2·5	3·5 3·0	do. do.
Special Chick Food	89	Parsons	Parson Pty. Ltd.	Wheat, green peas, maize, sorghum seed, shell grit	8·0	1·5 0·5	4·5	0·5 *Nil*	1·0 0·5	4·0 3·0	
15% Protein Vitamised Growers Pellets	115	Thomas	W. Thomas & Co. (W.A.) Ltd.	Bran, pollard, gristed grains, wheat germ, meat meal and/or whale meal and/or dried solubles, oyster flour, vitamins A and D_3, riboflavin, Christmas phosphate, manganese sulphate	15·0	2·5*	6·0	1·0 0·5	3·5 1·0	3·75 0·5	Vitamin A 5,000,000 I.U./ton Vitamin D_3 1,500,000 I.U./ton
18% Antibiotic Vitamised Chick Crumbles with "Nefco"	116	do.	do. do. do.	Bran, pollard, cereal meals, wheat germ, meat meal and/or whale meal, dried solubles, oyster flour, riboflavin, procaine, penicillin, vitamins A and D_3, nitrofurazone, bone flour and/or Christmas phosphate, lucerne pollard, manganese sulphate, vitamin K	18·0	2·5*	6·0	1·0 0·25	3·0 1·0	2·5 1·0	do. do.
18% Antibiotic Vitamised Chick Crumbles	117	do.	do. do. do.	Bran, pollard, gristed grains, wheat germ, meat meal and/or whale meal, dried solubles, oyster flour, riboflavin, procaine, penicillin, vitamins A and D_3, bone flour, and/or Christmas phosphate, lucerne pollard, manganese sulphate, milk powder, vitamin K	18·0	2·5*	6·0	1·0 0·25	3·0 1·0	2·5 1·0	do. do.
Chicken Grain	122	do.	do. do. do.	Wheat, maize, peas, shell grit	9·0	1·5*	4·5				
15% Protein Vitamised Chick Grower	125	do.	do. do. do.	Bran, pollard, gristed grains, wheat germ, meat meal and/or whale meal and/or dried solubles, oyster flour, vitamins A and D_3, riboflavin, Christmas phosphate, manganese sulphate, sodium chloride	15·0	2·5*	6·0	1·0 *Nil*	3·5 1·0	3·75 0·5	do. do.
Chick Starter	135	Morlay	R. B. Young Products Pty. Ltd.	Wheat meal, bran, dried yeast, whale meal, bone meal, meat meal, shell grit, antibiotics, nefco, manganese sulphate, minerals, apac, buttermilk	18·0	3·0*	5·5	2·0 0·25	3·5 1·0	4·0 1·5	Vitamin A 3,300 I.U./lb. Vitamin D_3 330 I.U./lb.
Chick All Mash Vitamised Fortified (A and D_3)	136	do.	do. do. do.	Wheat meal, bran, meat meal, whale meal, bone meal, oyster shell grit, dried yeast, apac, nefco concentrates, manganese sulphate, minerals	15·0	3·0*	6·0	2·0 0·25	3·0 1·0	4·0 1·5	do. do.
Growing Mash Vitamin Fortified (A and D_3)	137	do.	do. do. do.	Wheat meal, bran, pollard, meat meal, bone meal, whale meal, oyster shell flour, dried yeast, ribon, minerals, apac	14·0	3·0*	5·5	3·0 0·25	3·0 1·0	4·0 1·5	do. do.

* Minimum.

STOCK FOODS—continued

Stock Food	Applic. No.	Brand	By whom registered	Materials from which made	Registered Analysis						
					Crude Protein	Crude Fat	Crude Fibre	Sodium Chloride (NaCl)	Phosphoric Acid (P_2O_5)	Calcium (Ca)	Percentages of other substances claimed to be of reputed Medicinal or Nutritive Value
					(Min.) %	(Max.) (Min.) %	(Max.) %	(Max.) (Min.) %	(Max.) (Min.) %	(Max.) (Min.) %	%
B.—Compound Foods—*continued*											
5.—*Chicken Foods—ctd.*											
Cockerel Mash 16% Protein Vitamin Fortified (A and D_3)	140	Morlay	R. B. Young Products Pty. Ltd.	Wheat meal, bran, meat meal, whale meal, bone meal, buttermilk, antibiotics, nefco concentrates, apac concentrates ribon, minerals, manganese sulphate	16·0	3·0*	5·5	3·0 0·25	3·0 1·0	4·0 1·5	Vitamin D_3 330 I.U./lb.
Cockerel Mash 18% Protein Vitamin Fortified (A and D_3)	141	do.	do. do. do.	Wheat, meat, whale and bone meals, bran, manganese sulphate, ribon and apac concentrates, minerals	18·0	3·0*	5·5	3·0 0·25	3·0 1·0	4·0 1·5	do. do.
18% Protein Antibiotic Vitamised Chick Starter with Nitrofurazone	142	Thomas	W. Thomas & Co. (W.A.) Ltd.	Bran, pollard, cereal meals, wheatgerm, meat and/or whale meals, lucerne pollard, oyster flour, bone flour and/or Christmas phosphate, riboflavin, procaine penicillin, milk powder, manganese sulphate, vitamins A and D_3, nitrofurazone, pea meal	18·0	2·5*	6·0	1·0 0·25	3·0 1·0	2·5 1·0	Vitamin A 5,000,000 I.U./ton Vitamin D_3 1,500,000 I.U./ton
18% Protein Antibiotic Vitamised Chick Starter	143	do.	do. do. do.	do. do. do. minus nitrofurazone	18·0	2·5*	6·0	1·0 0·25	3·0 1·0	2·5 1·0	do. do. do.
Chick Pellets "A", AB, A and D_3	150	Red Comb	Westralian Farmers Co-op. Ltd.	Bran, pollard, cracked wheat, oat meal and bone meals, buttermilk, vitamins A and D_3, antibiotics, riboflavin	16·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·3 0·8	Vitamin A 2,000 I.U./lb. Vitamin D_3 180 chick units/lb.
Chick Pellets "A", AB, A and D_3 with Nicarbazine	151	do.	do. do. do.	Bran, pollard, cracked wheat, oat, bone and meat meals, buttermilk, vitamins A and D_3, riboflavin, antibiotics, nicarbazine	16·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·3 0·8	do. do. Nicarbazine 0·0125%
Chick Crumbles "A", AB, A and D_3	152	do.	do. do. do.	do. do. do. minus nicarbazine	16·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·3 0·8	Vitamin A 2,000 I.U./lb. Vitamin D_3 180 chick units/lb.
Chick Crumbles "A," AB, A and D_3 with Nicarbazine	153	do.	do. do. do.	do. do. do. plus nicarbazine	16·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·3 0·8	Vitamin A 2,000 I.U./lb. Vitamin D_3 180 chick units/lb. Nicarbazine 0·0125%
Chick Pellets "B," A and D_3	154	do.	do. do. do.	Bran, pollard, rolled wheat, meat, oat and bone meals, butter milk, vitamins A and D_3	15·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·3 0·8	Vitamin A 2,000 I.U./lb. Vitamin D_3 180 chick units/lb.
Chick Pellets "B," A and D_3 with Nicarbazine	155	do.	do. do. do.	do. do. do. plus nicarbazine	15·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·3 0·8	do. do. do. Nicarbazine 0·0125%
Growers Pellets A and D_3	156	do.	do. do. do.	Bran, pollard, rolled wheat, bone meal and oat meals, stabilised vitamins A and D_3	14·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·5 1·0	Vitamin A 2,000 I.U./lb. Vitamin D_3 180 chick units/lb.
Cockerel Pellets "A," AB, A and D_3	163	do.	do. do. do.	Gristed wheat, bran, buttermilk, brewers yeast, whale meat and bone meals, manganese sulphate, antibiotics, vitamin A and D_3, riboflavin	18·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	Vitamin A 2,000 I.U./lb. Vitamin D_3 400 I.U./lb.

Cockerel Pellets "A," AB, A and D_3 with Nicarbazine	164	do.	do.	do.	do.	Gristed wheat, bran, buttermilk, brewers yeast, whale meat and bone meals, manganese sulphate, antibiotics, vitamin A and D_3, riboflavin, nicarbazine	18·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	Vitamin A 2,000 I.U./lb. Vitamin D_3 400 I.U./lb. Nicarbazine 0·0125%
Cockerel Crumbles "A," AB, A and D_3	165	do.	do.	do.	do.	do. do. do. minus nicarbazine	18·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	Vitamin A 2,000 I.U./lb. Vitamin D_3 400 I.U./lb.
Cockerel Crumbles "A," AB, A and D_3 with Nicarbazine	166	do.	do.	do.	do.	do. do. do. plus nicarbazine	18·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	do. do. Nicarbazine 0·0125%
Cockerel Pellets "B," A and D_3	167	do.	do.	do.	do.	Gristed wheat, bran, meat, whale and bone meals, manganese sulphate, stabilised vitamins A and D_3	18·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	Vitamin A 2,000 I.U./lb. Vitamin D_3 400 I.U./lb.
Cockerel Pellets "B," A and D_3 with Nicarbazine	168	do.	do.	do.	do.	do. do. do. plus nicarbazine	18·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	do. do. Nicarbazine 0·0125%
Turkey Starter Pellets A and D_3	169	Wesfarmers	do.	do.	do.	Bran, pollard, gristed oats, wheat, buttermilk, dried yeast, meat and bone meals, vitamins A and D_3	24·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	Vitamin A 4,000 I.U./lb. Vitamin D_3 600 I.U./lb.
Turkey Growers Pellets A and D_3	170	do.	do.	do.	do.	do. do. do.	20·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	do. do.
"P" Chick Mash "A," AB, A and D_3	177	do.	do.	do.	do.	do. do. do. plus antibiotics and riboflavin	16·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·3 0·8	Vitamin A 2,000 I.U./lb. Vitamin D_3 180 chick units/lb.
"P" Chick Mash "A," AB, A and D_3 with Nicarbazine	178	do.	do.	do.	do.	Bran, pollard, cracked wheat, oat, meat and bone meals, buttermilk, antibiotics, vitamins A and D_3, riboflavin, nicarbazine	16·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·3 0·8	do. do. do. Nicarbazine 0·0125%
"P" Chick Mash "B," A and D_3	179	do.	do.	do.	do.	Bran, pollard, rolled wheat, oat, meat and bone meals, buttermilk, stabilised vitamins A and D_3	15·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·3 0·8	Vitamin A 2,000 I.U./lb. Vitamin D_3 180 chick units/lb.
"P" Chick Mash "B," A and D_3 with Nicarbazine	180	do.	do.	do.	do.	do. do. do. plus nicarbazine	15·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·3 0·8	do. do. do. Nicarbazine 0·0125%
"P" Growers Mash A and D_3	181	do.	do.	do.	do.	Bran, pollard, rolled wheat, oat meal, meat meal, bone meal, stabilised vitamins A and D_3	14·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·5 1·0	Vitamin A 2,000 I.U./lb. Vitamin D_3 180 chick units/lb.
Cockerel Mash "A," A and D_3	182	do.	do.	do.	do.	Gristed wheat, bran, buttermilk, brewers yeast, meat, whale and bone meals, manganese sulphate, antibiotics, vitamins A and D_3, riboflavin	18·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	Vitamin A 2,000 I.U./lb. Vitamin D_3 400 I.U./lb.
Cockerel Mash "A," AB A and D_3, with Nicarbazine	183	do.	do.	do.	do.	do. do. do. plus nicarbazine	18·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	do. do. Nicarbazine 0·0125%
Cockerel Mash "B," A and D_3	184	do.	do.	do.	do.	Gristed wheat, bran, meat, whale and bone meals, manganese sulphate, vitamins A and D_3	18·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	Vitamin A 2,000 I.U./lb. Vitamin D_3 400 I.U./lb.
Cockerel Mash "B," A and D_3 with Nicarbazine	185	do.	do.	do.	do.	do. do. do. plus nicarbazine	18·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	do. do. Nicarbazine 0·0125%
Turkey Starter Mash A and D_3	186	do.	do.	do.	do.	Bran, pollard, gristed oats, rolled wheat, dried yeast, buttermilk, meat and bone meals, stabilised vitamins A and D_3	24·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	Vitamin A 4,000 I.U./lb. Vitamin D_3 600 I.U./lb.
20% Protein Turkey Growers Mash A and D_3	187	do.	do.	do.	do.	do. do. do.	20·0	5·0 3·0	7·0	1·0 *Nil*	2·0 1·0	2·0 1·0	do. do. do.

* Minimum.

Stock Food	Applic. No.	Brand	By whom registered	Materials from which made	Registered Analysis: Crude Protein	Crude Fat	Crude Fibre	Sodium Chloride (NaCl)	Phosphoric Acid (P_2O_5)	Calcium (Ca)	Percentages of other substances claimed to be of reputed Medicinal or Nutritive Value
					(Min.) %	(Max.) (Min.) %	(Max.) %	(Max.) (Min.) %	(Max.) (Min.) %	(Max.) (Min.) %	%
B.—Compound Foods—*continued*											
5.—Chicken Foods—ctd.											
Fortified Chick Starter	211	Bairds	Biards Pty. Ltd.	Bran, pollard, meat, whale and bone meals, salt, butterfat, oyster flour, riboflavin, vitamins A and D_3, Manganese sulphate, terramycin (TM5)	17·0	4·0 3·5	5·0	1·0 0·75	3·0 2·5	3·5 3·0	Manganese sulphate 0·025% Terramycin (TM5) 0·075%
Fortified Growing Mash	212	do.	do. do.	do. do. do.	15·0	4·0 3·5	5·0	1·0 0·75	3·0 2·5	3·5 3·0	do. do. do.
Chick Starter Pellets....	236	Boans	Boans Ltd.	Bran, pollard, crushed wheat, oatmeal and bone meal, buttermilk, vitamins A and D_3, antibiotics and nicarbazine	16·0	5·0 3·0	7·0	1·0 *Nil*	2·3 1·2	1·3 0·8	Vitamin A 2,000 I.U./lb. Vitamin D_3 180 chick units/lb. Nicarbazine 0·0125%
6.—Pig Foods											
14% Protein Pig Fattening Cubes	99	Thomas	W. Thomas & Co. (W.A.) Ltd.	Pollard, gristed grains, whale and meat meals, dried solubles, oyster flour, manganese sulphate, salt, Iodine, cobalt sulphate, Christmas phosphate	14·0	2·5*	6·5	2·0 1·0	3·75 1·0	4·0 1·0	Manganese 60·0 ppm Iodine 1·2 ppm Cobalt 3·0 ppm
16% Protein Antibiotic Vitamised Pig Grower Cubes	100	do.	do. do. do.	Pollard, gristed grains, whale and and meat meals, dried solubles, oyster flour, procaine, penicillin, salt, vitamins A and D_3, manganese sulphate, iodine, cobalt, sulphate, Christmas Phosphate	16·0	2·5*	6·5	2·0 1·0	3·5 1·0	4·5 1·0	Vitamin A 6,000,000 I.U./ton Vitamin D_3 1,800,000 I.U./ton Manganese 60·0 ppm Iodine 1·2 ppm Cobalt 3·0 ppm
18% Protein Antibiotic Vitamised Pig Starter Pellets	101	do.	do. do. do.	do. do. do.	18·0	2·5*	6·5	2·0 1·0	3·75 1·0	4·0 1·0	do. do. do.
14% Protein Pig Fattening Mash	102	do.	do. do. do.	Pollard, gristed grains, dried solubles, meat meal, oyster flour, manganese sulphate, stabilised iodine, cobalt sulphate, Christmas phosphate, salt	14·0	2·5*	6·0	2·0 1·0	3·75 1·0	4·0 1·0	Manganese 60·0 ppm Iodine 1·2 ppm Cobalt 3·0 ppm
16% Protein Antibiotic Vitamised Pig Grower	103	do.	do. do. do.	Pollard, gristed grains, meat and whale meals, salt, dried solubles, oyster flour, procaine, penicillin, vitamins A and D_3, manganese sulphate, iodine, cobalt sulphate, Chistmas Phosphate	16·0	2·5*	6·5	2·0 1·0	3·5 1·0	4·5 1·0	Vitamin A 6,000,000 I.U./ton Vitamin D_3 1,000,000 I.U./ton Manganese 60·0 ppm Iodine 1·2 ppm Cobalt 3·0 ppm
18% Protein Antibiotic Vitamised Pig Starter	104	do.	do. do. do.	do. do. do.	18·0	2·5*	6·5	2·0 1·0	3·75 1·0	4·0 1·0	do. do. do.
Pig Mash	138	Morlay	R. B. Young Products Pty. Ltd.	Wheat, pollard, oyster flour, rock phosphate, cereal meals, meat and whale meals, dried solubles, limestone minerals, apac	14·0	3·0*	5·5	3·0 0·25	3·0 1·0	4·0 1·5	Vitamin A 3,300 I.U./lb. Vitamin D_3 330 I.U./lb.

Pig Growers Mash	192	Wesfarmers	Westralian Farmers Co-op. Ltd.	Bran, pollard, wheat, barley, oat meals and bone meals, oyster flour	16·0	6·0 3·0	7·0	1·0 *Nil*	4·0 2·0	1·0 *Nil*	
Pig Growers Pellets	193	Red Comb	do. do. do.	do. do. do.	16·0	6·0 3·0	7·0	1·0 *Nil*	4·0 2·0	3·0 1·0	
Pig Food	218	Eve-Lyn	Tropical Traders and Patersons Ltd.	Gristed wheat, barley, rye, pollard, limestone, salt, chalk, sulphate, animal charcoal, sulphate of iron, limonite, copper sulphate, coriander, arecanut, foenugreek	5·0	1·0*	5·0	9·6 8·6	3·75 3·25	9·5 8·25	
7.—Horse Foods.											
Horse Food	215	Eve-Lyn	Tropical Traders & Paterson's Ltd.	Gristed barley and wheat, pollard, whole linseed, salt, chalk, magnesium, sulphate, sulphur, sulphates of iron and copper, sodium bicarbonate and medicinal herbs	8·5	3·0 2·0	7·0	5·0 4·5	1·0 0·5	1·75 0·75	Sulphur 1·25
8.—Dog Foods.											
Dog Candy "Munchies"	1	K9	Zest Manufacturing Co. Ltd.	Yeast, liver, meat meal, cod liver oil, cheese, fish, bone meal, wheat, dried eggs, wheat germ	23·0	7·0 6·0	2·0	4·0			
Dog Biscuits "Kibblets"	2	do.	do. do. do.	Meat, fish, cheese, charcoal, liver, vegetables with chlorophyll	15·0	3·5 2·0	2·0				
Dog Biscuits	3	do.	do. do. do.	Meat, liver, fish, cheese, bone meal, vegetables, salt, charcoal	15·0	3·5 2·0	2·0	2·0			
Dog Biscuits "Fives"	4	do.	do. do. do.	Meat, liver, cheese, vegetables, charcoal, chlorophyll	15·0	3·5 2·0	2·0	2·0			
Dog Food	31	Jonah	Hunts Canning Co. Pty. Ltd.	Crushed wheat and whale meat	21·4	7·5 5·1	0·3	0·27			
Dog and Cat Food	40	Tucker Box....	Tucker Box Dog and Cat Food Co.	Meat and meat by-products, cereals, vegetables, salt	10·0	5·0 2·5	0·5	1·0			
20% Protein Kanine Kibbles	95	Thomas	W. Thomas & Co. (W.A.) Ltd.	Predigested cereal meal, wheat germ, grain meals, meat meal, milk powder, molasses, oyster flour, bone flour, sodium chloride, potassium iodide, vitamins A and D_3, vitamin B_1	20·0	1·0*	1·5	0·5*	2·5 0·5	2·5 0·5	Vitamin A 6,000,000 I.U./ton Vitamin D_3 1,800,000 I.U./ton
Charcoal Shapes	128	Snaps	Snaps Dog Foods	Whole meal, flour, wheat germ, bone flour, meat and whale meals, and solubles, milk powder, molasses, iodised salt, vitamins A and D_3, charcoal	20·0	2·5 2·0	6·0	0·6 0·5	3·0 2·5	3·0 2·5	
Puppy Meal	129	do.	do. do.	do. do. do. minus charcoal	20·0	4·5 4·0	1·5	0·6 0·5	3·0 2·5	3·0 2·5	
Mixed Shapes	130	do.	do. do.	do. do. do. plus charcoal	20·0	2·5 2·0	2·6	0·6 0·5	3·0 2·5	3·0 2·5	
No. 1 Dog Biscuits	131	do.	do. do.	Whole meal flour, wheat germ, bone flour, meat and whale meals and solubles, milk powder, molasses, iodised salt, vitamins A and D_3	20·0	2·5 2·0	1·5	0·6 0·5	3·0 2·5	3·0 2·5	
Dog Meal A and D_3	198	Wesfarmers....	Westralian Farmers Co-op. Ltd.	Grain meals, bran, pollard, dried yeast, salt, buttermilk, bone and meat meals, vitamins A and D_3	20·0	8·0 4·0	5·0	2·0 1·0	2·5 1·0	3·0 1·0	Vitamin A 4,000 I.U./lb. Vitamin D_3 450 I.U./lb.
Dog Pellets A and D_3	199	do.	do. do. do.	do. do. do.	20·0	8·0 4·0	5·0	2·0 1·0	2·5 1·0	3·0 1·0	do. do.

* Minimum.

Stock Food	Applic. No.	Brand	By whom Registered	Materials from which Made	Registered Analysis: Sodium Chloride (NaCl) % (Max.)	Phosphoric Acid (P_2O_5) % (Min.)	Lime (CaO) % (Min.)	Magnesia (MgO) % (Min.)	Iron (Fe) % (Min.)	Sulphur (S) % (Min.)	Iodine (I) % (Min.)	Copper (Cu) % (Min.)	Cobalt (Co) % (Min.)	Manganese (Mn) % (Min.)	Potassium (K) % (Min.)	Zinc (Zn) % (Min.)	Other
C.—Stocklicks.																	
1.—*Bone Meals.*																	
Sterilised Bone Grit	7	Tri-cal-os	Davis Gelatine (Aust.) Pty. Ltd.	Bones	....	30·0	40·0	....	....	....	....	....	....	....	....	....	Protein 5·0*
Sterilised Bone Flour	8	do.	do. do.	do.	....	30·0	40·0	....	....	....	....	....	....	....	....	....	do.
Whale Bonemeal	11	Wrights	Wrights Ltd.	Whale bone	1·0	27·0	28·0	....	....	....	....	....	....	....	....	....	Protein 8·5*
Bone Meal	25	Watsonia	Watsons Foods Pty. Ltd.	Abattoir offal, bones	....	26·5	36·0	....	....	....	....	....	....	....	....	....	Protein 14·0*
Bone Meal	30	Ancho	Anchorage Butchers Pty. Ltd.	Waste meat products	Trace	26·76	26·95	....	....	....	....	....	....	....	....	....	Protein 23·63* Fat 2·44* Fibre Trace
Bone Meal	82	W.A.M.E.	W.A. Meat Export Works	Selected bones	0·25	24·0	27·0	....	....	....	....	....	....	....	....	....	Protein 18·75
2.—*Oyster Flours.*																	
Oyster Flour	56	Deans	J. Deane & Son	Shell	0·5	Trace	42·0										
Oyster Flour	92	Thomas	W. Thomas & Co. (W.A.) Ltd.	Oyster shell	1·0	*Nil*	42·0										
3.—*Mineral Phosphate.*																	
Phosphate Feeding Supplement	91	Christmas Phos.	do. do.	Precipitated Christmas phosphate	*Nil*	36·6	44·8										
4.—*Mixed Stock Licks.*																	
Aquamin Concentrate	18	K.C.C.	Kwinana Chemical Co.	Superphosphate and phosphoric acid, copper ore and cobalt sulphate	....	31·0	3·0	....	Trace	....	....	0·6	0·1	Trace	Trace	Trace	
Phosphamin	19	do.	do. do.	Phosphoric acid, cobalt chloride, copper sulphate	....	20·0	....	....	....	....	....	1·25	1·25				
Aquamin Double Concentrate	20	do.	do. do.	do. do. do.	....	60·0	....	....	....	....	....	0·4	0·2				
Cobalphos	21	do.	do. do.	Superphosphate and cobalt sulphate	....	20·0	....	....	....	....	....	....	5·0				
Monophos	22	do.	do. do.	Monosodium phosphate	....	58·0											
Superex	23	do.	do. do.	Superphosphate	....	30·0	4·0										
Concentrated Lick	32	Vic-Lic	Wilcox Mofflin Ltd.	Bone char, ground limestone, cobalt chloride	*Nil*	24·3	49·2	....	....	....	....	....	·0165				
Medicated Calcium	35	Blue Peter	Agricultural Products Co.	Ground limestone, limonite, sulphate of minerals	1·0	....	45·0	....	3·5	....	....	1,500 ppm	285 ppm	600 ppm			
Medicated Salt Block "B"	36	do.	do. do.	Salt, ground limestone, sulphate of minerals	70·0	....	6·0	....	1·5	....	....	550 ppm	95 ppm	200 ppm			
Minorels	37	do.	do. do.	Ground phosphate rock, ground limestone, limonite, borax, sulphates of minerals	10·0	5·0	20·0	1,200 ppm	4·0	....	....	5,000 ppm	550 ppm	1,000 ppm	....	500 ppm	Boron (B) 200 ppm
Sol-u-min C270	38	David Gray's	David Gray & Co. Ltd.	Copper sulphate, cobalt chloride, urea, mono ammonium phosphate	....	25·0	....	....	....	....	....	0·6	0·07	....	....	....	Nitrogen (N) 27·0
Sol-u-min C345	39	do.	do. do.	Cobalt chloride, copper sulphate, urea, ground limestone, iron oxide	....	....	....	....	....	....	....	0·095	0·015	....	....	....	Calcium (Ca) 7·5

Denmark Cobalt Lick	41	C.S.M.L.	Cuming Smith Mt. Lyell F.F. Ltd.	Limonite, sulphate of copper, salt	38·0	....	....	....	....	....	....	0·14	20 ppm				
Poultry Powder Iodised	46	Rawleigh's	W. T. Rawleigh Co. Ltd.	Oyster shell, sulphur, potassium iodide, copperas, iodine, sulphate, ground bone, manganese sulphate, cobalt sulphate, zinc sulphate, quassia, defluorinated phosphate, mineral oil	....	16·5	38·7	....	400 ppm	4·0	100 ppm	40 ppm	100 ppm	120 ppm	40 ppm	100 ppm	
Mineralised Supplement for Stock	47	do.	do. do.	Salt, sulphur, copperas, sodium phosphate, potassium iodide, calcium carbonate, cobalt sulphate, defluorinated phosphate, mineral oil, molasses and medicinal herbs	15·0	12·24	27·0	....	1,000 ppm	3·5	220 ppm	....	10 ppm	....	80 ppm	....	Calcium (Ca) 13·42 Sodium (Na) 70 ppm
Rock Salt	58	Elders	Elder Smith & Co. Ltd.	Sodium chloride, marl	95·0												
Mineral Food Supplement for Poultry	60	Watkins	The J. R. Watkins Co.	Calcium carbonate, magnesium carbonate, dicalcic phosphate, bone char, ferric oxide, ferrous sulphate, magnesium sulphate, ground sulphur, salt, mineral oil, green manganous oxide, cobalt sulphate, copper sulphate, zinc sulphate, potassium iodide	10·5	15·0	33·8	....	1·1	....	·0153	·0129	0·01	0·25	....	0·01	(Mg) 0·5
Mineral Food Supplement for Stock	61	Watkins	The J. R. Watkins Co.	Dicalcic phosphate, micronised rock phosphate, calcium carbonate, salt, ferric oxide, ferrous sulphate, ground sulphur, magnesium sulphate, iodine, copper, manganese, cobalt, zinc	9·0	15·0	32·0	0·7	1·1	....	·0176	·0129	0·01	·009	....	·001	
Concentrated Cattle Lick	70	Vita-Lick	Goldsbrough Mort & Co. Ltd.	Bone flour, bone charcoal, sodium sulphate, flowers of sulphur, limonite, potassium iodide, copper sulphate, cobalt chloride	*Nil*	28·2	36·1	....	3·5	0·45	·034	0·2	0·14	....	....	....	Sodium sulphate 3·0
Concentrated "D" (Cobaltised and Copperised)	71	do.	do. do.	do. do. do.	*Nil*	30·0	38·75	....	1·25	2·0	·034	0·2	·014	....	....	....	Sodium sulphate 1·8
Mineral Supplement for Pigs	72	Por-co-vite	do. do.	Bone flour, bone charcoal, sodium sulphate, flowers of sulphur, sodium chloride, limonite, calcium carbonate, copper sulphate, cobalt chloride, potassium iodide	14·0	19·14	29·32	....	0·62	9·6	·052	1·0	·003	....	....	....	Sodium sulphate 2·6
Stock Conditioner	73	Luff's Blue Label	Stam Products	Yeast, maize, oil, meal, ceromel, oil of aniseed, boric acid, thiamine hydrochloride, salts of iron, copper, manganese zinc and cobalt	....	....	....	....	16·46 ppm	....	....	53·3 ppm	49·6 ppm	50·7 ppm	....	56·4 ppm	Vitamin B1 27,700 I.U./lb.
Phosphate Nuts and Cobalt	93	Thomas	W. Thomas & Co. (W.A.) Ltd.	Pollard, Christmas phosphate, salt, molasses, cobalt	10·0	9·0	11·0	....	....	....	....	....	50 ppm				
Phosphate Cubes....	200	Wesfarmers	Westralian Farmers Co-op. Ltd.	Ground phosphate rock, pollard, cobalt chloride	....	18·0	15·0	....	....	....	....	....	50 ppm				

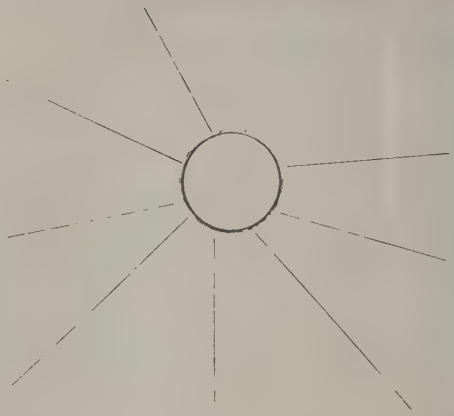
* Minimum

Stock Food	Applic. No.	Brand	By whom Registered	Materials from which Made	Registered Analysis: Sodium Chloride (NaCl)	Phosphoric Acid (P_2O_5)	Lime (CaO)	Magnesia (MgO)	Iron (Fe)	Sulphur (S)	Iodine (I)	Copper (Cu)	Cobalt (Co)	Manganese (Mn)	Potassium (K)	Zinc (Zn)	Other
C.—Stock Licks—*cont.*																	
4.—Mixed Stock Licks—continued					% (Max.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	
Cattle Lick	201	Wesfarmers	Westralian Farmers Co-op. Ltd.	Bone meal, salt, yeast, iron sulphate, zinc sulphate, copper sulphate, cobalt chloride, manganese sulphate, potassium, iodine, sulphur	80·0	1·0	5·0	....	1·2	3·3	150 ppm	220 ppm	92 ppm	200 ppm	50 ppm	80 ppm	
Sheep Lick	202	do.	do. do.	do. do. do.	80·0	1·0	5·0	....	1·2	3·3	150 ppm	220 ppm	92 ppm	200 ppm	50 ppm	80 ppm	
Sol-u-min C88	203	David Gray's	David Gray & Co. Ltd.	Copper sulphate, cobalt chloride, mono-ammonium phosphate	....	47·0	....	....	....	....	....	2·5	0·3	....	....	....	Nitrogen 8·8
Sol-u-min 90	204	do.	do. do.	Cobalt chloride, mono-ammonium phosphate	....	47·0	....	....	....	....	....	....	0·3	....	....	....	Nitrogen 9·0
Sol-u-min Phosphate 120	205	do.	do. do.	Mono-ammonium phosphate	....	59·0	....	....	....	....	....	....	....	....	....	....	Nitrogen 12·0
Sol-u-min Special	206	do.	do. do.	Cobalt chloride, mono-ammonium phosphate	....	37·0	....	....	....	....	....	....	1·5	....	....	....	
Cattle Lick	207	do.	do. do.	Sodium chloride, iron sulphate, copper sulphate, cobalt sulphate, manganese sulphate, potassium iodide, bone meal, yeast	80·0	1·0	5·0	....	1·2	3·3	150 ppm	220 ppm	92 ppm	200 ppm	50 ppm	80 ppm	
Sheep Lick	208	do.	do. do.	do. do. do.	80·0	1·0	5·0	....	1·2	3·3	150 ppm	220 ppm	92 ppm	200 ppm	50 ppm	80 ppm	....
Mindif Salt Lick	209	Boots	Boots Pure Drug Co. (Aust.) Pty. Ltd.	Calcium, phosphorus, copper, iron, cobalt, manganese, iodine, salt	90·0	0·65	3·4	....	0·35	....	850 ppm	3000 ppm	300 ppm	170 ppm	....	....	....
Super Mindif	110	do.	do. do.	Calcium, phosphorus, copper, iron, cobalt, manganese, iodine, salt, sulphur	30·0	11·4	17·4	....	0·24	....	240 ppm	1800 ppm	300 ppm	510 ppm	....	....	Sulphur 0·75
Red Band	223	Min-a-Vit	Min-a-Vit Pty. Ltd.	Bone dust, talc, calcium carbonate, salt, molasses, copper, sulphate, zinc sulphate, manganese sulphate, cobalt sulphate, iron oxide, potassium iodide, vitamin D_3	16·0	12·0	18·0	6·0	·625	....	·043	·025	·009	·032	....	·022	Vitamin D_3 320 I.U./gram
Red Band Plus Pack	224	Min-a-Vit	Min-a-Vit Pty. Ltd.	do. do. do. plus vitamin A	16·0	12·0	18·0	6·0	·625	....	·043	·025	·009	·032	....	·022	Vitamin A 6,250 I.U./oz. Vitamin D_3 320 I.U./gram
Orange Band	225	do.	do. do.	Bone dust, talc, whiting, salt, molasses, copper, zinc, cobalt and manganese sulphates, potassium iodide, vitamin D_3	21·0	18·0	22·0	2·0	....	....	·043	0·25	·009	·032	....	·022	....
Orange Band Plus Pack	226	do.	do. do.	Bone dust, talc, calcium carbonate, salt, molasses, copper, zinc, cobalt and manganese sulphates, potassium iodide, vitamin concentrates A and D_3	21·0	18·0	22·0	2·0	....	....	·043	0·25	·009	·032	....	·022	Vitamin A 12,200 I.U./oz. Vitamin D_3 320 I.U./gram

Black Band	227	do.	do. do.	Bone flour, calcium carbonate, manganese sulphate, iron oxide, potassium iodide, sodium chloride, cobalt, sulphate, copper sulphate, vitamin D_3	15·0	27·0	40·0	....	·077	....	·03	·0025	·002	·42	....	....	Vitamin D_3 215 I.U./gram Riboflavin 130 Mg/lb.
Black Band Plus Pack	228	do.	do. do.	do. do. do. plus vitamin A	15·0	27·0	40·0	....	·077	....	·03	·0025	·002	·42	....	....	do. do. Vitamin A 1,090 I.U./gram
Sheep Pack	229	do.	do. do.	Bone dust, talc, calcium carbonate, molasses, copper sulphate, zinc sulphate, cobalt sulphate, manganese sulphate, potassium iodide, vitamin concentrate D_3	5·0	17·241	33·691	2·85	....	....	·042	·099	·037	·03	....	·02	Vitamin D_3 320 I.U./gram Sucrose 8·839
Sheep Plus Pack	230	do.	do. do.	do. do. do. plus vitamin A	5·0	17·241	33·691	2·85	....	....	·042	·099	·037	·03	....	·02	do. do. Vitamin A 475 I.U./gram
Poultry Spice	234	Dayson & Hewitt	Boans Ltd.	Wheat, offals, spices and mineral salts	1·0	....	10·0	....	....	1·2	38 ppm	128 ppm	21 ppm	1720 ppm	....	....	Min. Protein 3·6 Max. Fibre 1·9 Max. Fat 4·8 Min. Fat 1·0
Iodised Mineral Lick	235	do.	do.	Limestone, flour, sterilised feeding bone salt, iron sulphate, ferric oxide sulphate, potassium iodide, copper sulphate, cobalt sulphate	83·7	1·72	5·25	....	·71	·49	·03	·06	·004	....	·01	....	....
Complete Mineral Supplement	240	Nutro-Min Powder	Page Boy Products (W.A.)	Salt, eggshell meal, bone flour, iron, copper, cobalt, manganese, potassium iodide	26·2	16·4	30·6	....	0·35	....	80 ppm	600 ppm	100 ppm	170 ppm	....	500 ppm	....
Complete Mineral and Vitamin Supplement	241	Nutro-Vitra-Powder	do. do.	Eggshell meal, boneflour, blackstrap molasses, salt, iron, potassium iodide, copper, cobalt, manganese, salt, vitamins A and D_3	26·2	16·4	29·7	....	·035	....	80 ppm	600 ppm	100 ppm	170 ppm	....	500 ppm	Vitamin A 180,000 I.U./lb. Vitamin D_3 18,000 I.U./lb.
Complete Trace Mineral Supplement for Layers	242	Nutro-Min Powder	do. do.	Salt, eggshell, meal, coneflour, copper, cobalt, manganese, iron, potassium iodide	13·5	22·7	30·3	....	0·35	....	10 ppm	100 ppm	50 ppm	2000 ppm	....	80 ppm	....
Complete Trace Vitamin and Mineral Supplement for Layers	243	Nutro-Vitra-min Powder	do. do.	Eggshell meal, boneflour, crude blackstrap molasses, salt, iron, potassium, iodide, copper, cobalt, manganese, vitamins A and D_3	13·5	22·7	30·3	....	....	....	10 ppm	100 ppm	50 ppm	2000 ppm	....	80 ppm	Riboflavin 84 Mg/lb Vitamin A 330,000 I.U./lb. Vitamin D 45,000 I.U./lb.

* Minimum

BEAT the SUN



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TELEPHONE 74 1215

Fig 1—Couch grass controlled around the base of a three year old citrus tree by spraying with Dalapon

Weed Research

5.—Weed Control in Orchards

By G. A. PEARCE, B.Sc. (Agric.), Adviser, Biological Services Division, and S. E. HARDISTY, B.Sc. (Agric.), Adviser, Horticultural Division.

ALTHOUGH trials in Western Australia have shown that chemicals such as Dalapon, Amitrol, C.M.U. and P.C.P. can be used with safety for the control of weeds in orchards, cultivation still remains the most important method of control. The use of chemicals to eliminate cultivation completely is possible but seldom desirable.

The growth of weeds in orchards is not always harmful. They supply organic matter and by providing soil cover late summer weeds are often of great help in preventing erosion likely to be caused by heavy opening rains.

During the spring and summer months, however, weeds compete strongly with fruit trees for available soil moisture and nutrients, and the control of weeds at this time is most desirable.

CULTIVATION

Cultivation is not only a cheap and effective means of weed control but is also a means of incoporating fertilisers and green cover crops into the soil.

However, cultivation has a number of disadvantages. By cutting the surface roots, cultivation reduces the feeding area of the tree. This can be very important during the spring when good growing conditions are required for fruit setting.

Also, cultivation, when the soil is too wet or too dry destroys the physical structure of the soil forming a compact layer below the surface which becomes almost impermeable to water and root penetration.

Despite these disadvantages the great benefit obtained by controlling weed growth makes regular cultivation essential.

CHEMICAL CONTROL

Although chemicals could be used to virtually eliminate the need for cultivation for weed control in orchards, a combination of both methods appears desirable. Chemicals could be used to advantage in the following situations—

(1) For the control of perennial grasses particularly around the tree trunks.

(2) For the control of summer-growing weeds where cultivation would lead to dusty conditions or interfere with irrigation equipment or tree props.

Fig. 2—The growth of weeds around this apple tree has been controlled by treating the bare soil with C.M.U. within a week of the germinating rains

(3) For the control of weeds around the trunks of trees following spring cultivation. This would greatly facilitate the control of many insect pests.

(4) For the control of weeds on steep hill slopes where cultivation is only desired in one direction. Chemicals could be used for the narrow strips missed along the tree rows.

Spraying Method—Weedkilling chemicals are normally applied at reasonably low pressures of from 50 to 100 lb. per square inch. The usual volume applied is from 80 to 150 gallons per acre. Where absorption is taking place through the leaf or stem sufficient solution should only be applied to wet the absorbing surface. Any run-off is wasted. The addition of a wetting agent such as a household detergent is always an advantage.

Where it is desired to kill the weed seeds as they germinate it is essential to obtain an even application of the chemical to a reasonably smooth and clean surface. For this reason high volumes of application of from 100 and up to 300 gallons per acre should be used. In this case the most important factor is to spread the recommended amount of chemical evenly over the given area. Best results are usually obtained if the soil is moist at the time of application, say within a week of the germinating rains.

Normal orchard spraying equipment can be used to apply the chemicals mentioned, but some care is required to avoid contamination.

Although these chemicals have not the same residual dangers as the hormone sprays, such as 2,4-D, the equipment including the vat and hoses should be thoroughly washed after use.

When using weedkilling chemicals in orchards spraying the foliage of the trees should be avoided. By reducing the pressure to around 50 lb. per square inch the danger of spray drift will be greatly reduced.

Chemicals—The chemicals listed when sprayed around and under orchard trees such as apple, pear, citrus and stone fruits will not damage trees provided they are at least three years old. Using the rates of application recommended a considerable safety margin exists.

Some care should be taken to prevent spraying the foliage of the trees as damage can result.

1. *Dalapon* (sodium dichloropropionate)—This chemical is a selective grass weedkiller and has proved very effective against couch and Kikuyu grasses. The

rate of application for orchards should be 10 lb. of 85 per cent. Dalapon per complete acre. This means that when only applying sufficient solution to wet the weeds, without run-off, a suitable solution is made by dissolving 1 lb. of Dalapon in each 16 gallons of water. For the control of perennial grasses, although higher rates of application can be used best results have been obtained by making two applications at this rate with an interval of 10 to 14 days between treatments.

The chemical should be applied when the grasses are making active growth.

For the control of winter and summer growing annual grasses the rate of application should be reduced to 5 lb. of 85 per cent. Dalapon per acre. This means that a suitable solution is made by dissolving one half pound of Dalapon in 16 gallons of water.

It should be remembered that Dalapon is aborbed through the leaf of the grass and that it is not effective against broad leaved weeds.

2. *C.M.U.* (chlorophenyl dimethylurea) —C.M.U. can be used effectively for the control of nearly all winter-growing annual weeds for a period of 8 to 12 weeks. Applied at the rate of 2 lb. of 80 per cent. C.M.U. per complete acre (1 oz. in 5 gallons of water per 150 square yards) within a week of the germinating rains C.M.U. kills the weed seedlings as they emerge. For effective results it is important to obtain an even application to a reasonably smooth soil surface. C.M.U. is not highly soluble and it is essential to keep the mixture well agitated. This treatment can be used around tree trunks or on irrigated orchards where weeds are expected to appear.

For the control of summer annuals such as crabgrass and portulaca in irrigated orchards the rate of application should be increased to 4 lb. per acre (2 oz. in 5 gallons of water per 150 square yards). Best results will be obtained if the chemical is applied to the soil while the surface is still damp and while the weeds are in the very young seedling stage.

C.M.U. is particularly effective against portulaca and this weed can be controlled by spraying before or after emergence with C.M.U.

Fig. 3—The weeds around the bases of these trees could be controlled by treatment with Amitrol

3. *Amitrol* (Amino triazole)—Amitrol is a general purpose weedkiller which can be used in a number of ways. It is probably the most effective chemical for controlling heavy weed growth in orchards during the spring. It can also be applied to bare surfaces as described for C.M.U. to kill the weed population as it germinates. In this way it can control weed growth for a period of 8 to 12 weeks. Although Amitrol can be used for the control of couch grass in orchards, the use of Dalapon is preferred.

The recommended rate of application is 10 lb. of 50 per cent. Amitrol per acre. This means that when only applying sufficient spray to wet the weeds, without run-off,

Table 1

Weed	Time for Spraying	Chemical to Use	Rate	Comments
Perennial Grasses	When making active growth —November to April	Dalapon	1 oz. per gal.	Second application 10–14 days later. Further treatments as required.
Annual Grasses	Before emergence—within 7 days germinating rains	Amitrol or C.M.U.	1 oz. per gal. 1 oz. per 5 gal.	Repeat when weeds begin to persist.
	After general emergence	Dalapon	½ oz. per gal.	Spray when young.
Broad-leaved weeds and annual grasses	Before emergence—within 7 days of germinating rains	Amitrol or C.M.U.	1 oz. per gal. 1 oz. per 5 gal.	Repeat when weeds begin to persist.
	After general emergence	Amitrol	1 oz. per 5 gal.	Spray when young.
	Heavy growth—spring	Amitrol	1 oz. per 3 gal.	
Summer Weeds—				
Portulaca	Before or after emergence	C.M.U.	1 oz. per 3 gal.	Treatment before emergence spray when soil is damp.
Crabgrass	Before emergence	C.M.U.	1 oz. per 3 gal.	
	After emergence	Dalapon	½ oz. per gal.	Spray as required.
Fathen, Goosefoot, Nightshade	Before or after emergence	Amitrol	1 oz. per gal.	Repeat when weeds begin to persist.
Soursob, Nut Grass, Sorrel	Resistant			

Table 1 lists the more common weeds found in orchards and the recommended chemical for their control. Column 4 shows the amount required to make a suitable solution to just wet the weeds without run-off.

Table 2

AVAILABLE CHEMICALS

Chemical	Trade Name	Distributor	Concentration
			%
Dalapon	Basfapon	Henry York & Co. Ltd.	85
	Dowpon	Agricultural Products Co.	85
		Barrow Linton & Co. Ltd.	....
		David Gray & Co. Ltd.	....
		Elder Smith & Co. Ltd.	....
		Horticultural Industries Pty. Ltd.	....
		Kwinana Chemical Co.	....
		Lanes Pty. Ltd.	....
		Terra Trading Co.	....
		Westralian Farmers' Co-op.	....
		Wilcox Mofflin Ltd.	....
C.M.U.	David Gray's C.M.U.	David Gray & Co. Ltd.	80
	Telvar	Lane's Pty. Ltd.	80
	Terra C.M.U.	Terra Trading Co.	80
Amitrol	Weedazol	Barrow Linton & Co. Ltd.	50
P.C.P.	Nocweed P.C.P.	Lanes Pty. Ltd.	25
	Shell Weedkiller Q.	Shell Chemical Co.	15
	Pentacide	Kwinana Chemical Co.	20

Table 2 shows the proprietary lines of the chemicals discussed and the distributors known to the Department of Agriculture. All chemicals are powders except the P.C.P.

a suitable solution is made by dissolving 1 lb. of 50 per cent. Amitrol in each 16 gallons of water.

When the weeds are well developed a second application may be required some three weeks after the first, or the initial rate of application could be increased.

4. *P.C.P.* (Pentachlorophenol)—P.C.P. is a contact weedkiller which can be used for the control of annual weeds in orchards. The recommended rate of application is 10 lb. per acre. This means that a suitable solution is made by dissolving 7 fluid ounces of a 15 per cent. P.C.P. line in each gallon of water.

SUMMARY

(1) Various chemicals can be used to control most weeds growing in orchards.

(2) Cultivation is still the most important method of controlling weeds.

(3) Chemicals can be used to control weeds in orchards to advantage in many situations where cultivation is not desirable.

(4) Four different chemicals are recommended for the control of various weeds, in most cases more than one chemical could be used for the same purpose.

(5) Table 1 lists the most common weeds found in orchards and the recommended chemical for their control.

(6) Table 2 shows the trade names of proprietary lines available and the recommended rate of application for each chemical.

ACKNOWLEDGMENT

It is desired to thank Wilcox Mofflin Ltd., and Agricultural Services Pty. Ltd., who kindly supplied the Dalapon and Amitrol respectively used in these trials.

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(b) Junior Standard Bookkeeping.

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Gairdner River. Experiment 1, 1958. The plot at left received no sulphate of ammonia. That on the right received 112 lb./ac. Note the denser stand. The grain yields were 29 bush./ac. and 45 bush./ac. respectively.

THE USE OF NITROGEN FERTILISERS FOR CEREALS IN THE JERRAMONGUP—GAIRDNER RIVER DISTRICTS OF WESTERN AUSTRALIA

By W. J. TOMS, B.Sc. (Agric.), Research Officer, Plant Research Division

HIGH yields of oats have been obtained with nitrogen fertilisers on newly-developed scrub plain areas of the south coastal districts. This suggests that excellent crops can be expected here after the land has grown subterranean clover for a number of years. The use of nitrogen fertiliser on new land, in addition to super, copper and zinc has resulted in production of a much better straw for burning to control suckers and poison plants. Sulphate of ammonia at 56 lb. per acre, is a suitable application.

To the west of the Esperance Plain and contained roughly by the coast and a line drawn from Albany to Newdegate, thence to Hopetoun lies a largely undeveloped area with a potential as great as the Esperance Plain.

The War Service Land Settlement organisation has taken up some 400,000 acres in the middle of this area at Gairdner River, Jerramongup and Coracherup. Two hundred thousand acres of these holdings are now sown to subterranean clover and Wimmera ryegrass.

EXPERIMENTAL RESULTS

Cereal crops grown on experimental plots on new land at Jerramongup in 1956 gave low yields in spite of application of adequate superphosphate and the trace elements copper and zinc. It seemed that the area might, in this respect, resemble the Esperance Plain where satisfactory crops on new land were not often obtained. However, the use of sulphate of ammonia gave good yield increases in 1956 (see Table 1) and also produced a much better straw for firing to control suckers and poison.

Further experiments planted at Gairdner River in 1957 (see Table 2) and in 1958 (see Table 3) showed that excellent crops can be grown on new land in this area, particularly when a nitrogen fertiliser is used.

Experiment 2, 1958, was situated on a sandy soil near the Bremer Bay Road in the southern part of the Gairdner River W.S.L.S. project. This soil is representative of quite large areas of the country nearer the coast. It is considered generally inferior to the soils found further north through the Gairdner project to Jerramongup.

TABLE 1

Yields of Wheat and Oats with Sulphate of Ammonia at Jerramongup, 1956

(All plots received one bag (187 lb.) of copper-zinc-super per acre

	Without Sulphate of Ammonia	With 56 lb./acre Sulphate of Ammonia
Wheat Yield (bush./ac.)	10	16
Oat Yield (bush./ac.)	18	30

TABLE 2

Oat Yield Responses to Nitrogen Fertiliser at Gairdner River, 1957

(All plots received one bag (187 lb.) of copper-zinc-super per acre

Nitrogen Fertiliser Treatments	Oat Yields (bush./acre) Expt. 1	Expt. 2	Expt. 3
No Nitrogen Fertiliser	37	31	39
*Urea equal to 28 lb./ac. of Sulphate of Ammonia	41	....	.. .
*Urea equal to 56 lb./ac. of Sulphate of Ammonia	42	40	39
56 lb./ac. of Sulphate of Ammonia	....	38	41

* Shortly after urea is mixed with superphosphate the mixture becomes damp and is difficult to drill. Urea is therefore not recommended for cereals. Urea has advantages in that it is a more concentrated nitrogen source, is less toxic, and is slightly cheaper than sulphate of ammonia.

TABLE 3

Responses of Oats to Sulphate of Ammonia at Gairdner River, 1958

(All plots received one bag (187 lb.) of copper-zinc-super per acre

Nitrogen Fertiliser Treatments	Oat Yields (bush./acre) Experiment 1 (Gravelly Loamy Sand over Clay at variable depths, 3 to 18 inches)	Experiment 2 (Fine White Sand over Gravel at 6 to 12 inches)
No Nitrogen Fertiliser	29·2	25·2
28 lb./ac. Sulphate of Ammonia	31·4	26·6
56 " " " "	44·5	28·2
112 " " " "	45·4	32·0
224 " " " "	42·1	40·4

EFFECT OF EARLY GROWTH

In both the 1958 experiments all rates of sulphate of ammonia **reduced** early plant growth. This has occurred repeatedly on other experiments. However final yields are usually increased by using sulphate of ammonia.

In 1956 at Bremer Bay, sulphate of ammonia up to 168 lb./ac. was drilled with the oat seed, and in one treatment sulphate of ammonia at 168 lb./ac. was broadcast prior to drilling the seed. Early in the season the poorest plots were those receiving 168 lb./ac. drilled, while 168 lb./ac. broadcast gave the best growth. At the end of the season these two treatments gave the same yield, both being better than lower rates of sulphate of ammonia. It is considered that no permanent damage to the crop is likely by drilling sulphate of ammonia at 56 lb./ac. with the seed.

RATE OF FERTILISER TO USE

Sulphate of ammonia will not take the place of superphosphate. On new land it should be used in conjunction with a bag (187 lb.) of copper-zinc-super/acre.

Thus if sulphate of ammonia at 56 lb./ac. is to be applied, a total of about 240 lb/ac. of copper-zinc-sulphate of ammonia-super mixture would have to be drilled. This rate would supply super at 150 lb/ac.

DOES IT PAY?

Experience in other districts has shown that the response to sulphate of ammonia depends largely on the season. In a dry year or if the spring weather is too dry little increase in yield may be obtained. It is for this reason, and because of the appreciable monetary outlay involved, that sulphate of ammonia has not been generally recommended for new light land. In the southern districts where the chances of dry spring weather are least, the chances of benefits from sulphate of ammonia are considered good. In 1957, finishing rains were very poor (108 points for September and October) whereas in 1958 finishing rains were very good (473 points for September and October). This is reflected in the comparatively low yield responses to nitrogen obtained in 1957.

Fifty-six pounds of sulphate of ammonia costs approximately £1. Farmers of limited capital may obtain a better monetary return by spending this money on superphosphate for their new land, or on fencing, or on equipment, but when sucker and poison growth must be controlled by a stubble fire, the use of sulphate of ammonia at about 56 lb./ac. is recommended.

When crops are taken in two successive years on new light land in order to obtain two burns, sulphate of ammonia is even more necessary for the second crop.

Acknowledgment.

The author wishes to acknowledge the willing assistance given him by Mr. Colin Cameron of Jerramongup, and other War Service Land Settlement officers.

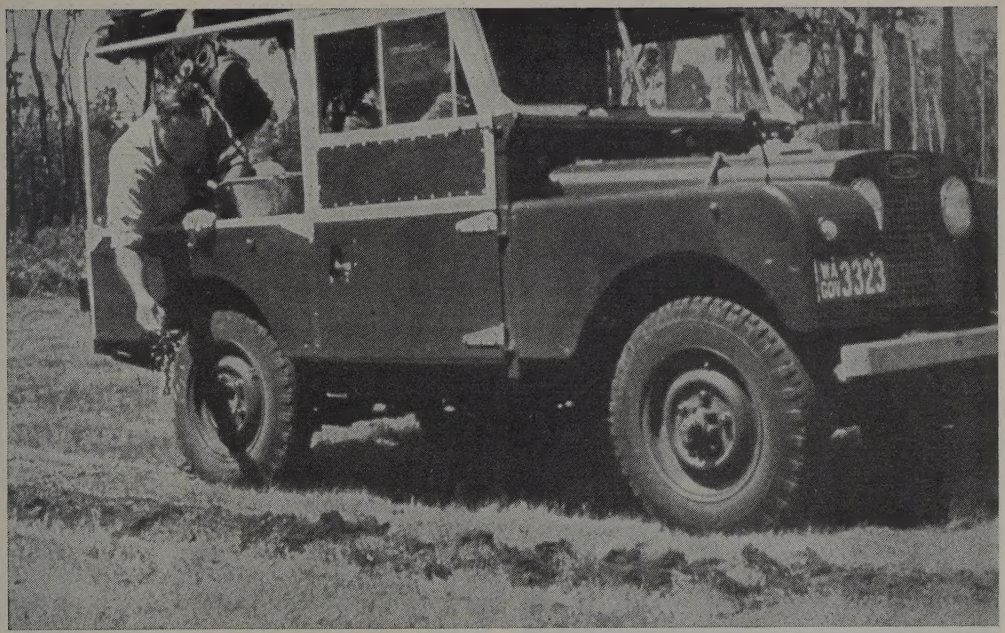

Fig. 1.—An Agriculture Protection Board officer, dropping oats poisoned with "1080" into a furrow on a rabbit-infested property

CURRENT COMMENTS ON VERMIN CONTROL

By A. R. TOMLINSON, Chief Vermin Control Officer.

THERE have been many reports of outbreaks of myxomatosis this season. Some of them have been of a high killing intensity and farmers have been led to hope that the disease has returned to wipe out the rabbit population altogether. The truth of the matter is that myxomatosis is now so well spread over the country that probably every rabbit here will be affected by the virus at some stage of its existence. This applies to the rest of the Australian mainland and, in every case where blood samples have been taken from rabbits, signs of the disease have been found.

Myxomatosis is now established in Australia's rabbit population and will doubtless remain permanently. The effect will gradually decline until eventually a balance will be reached as it has in South America where the virus is always present among the rabbits but will not kill them.

Until this happens, seasonal conditions will have a big influence on how active the disease will be. This season, for instance, has probably been almost ideal for myxomatosis transmission which has accounted for the widespread flare-ups. The pattern which may be expected will be the continuing decline in the effectiveness of myxomatosis with intermittent upsurges in favourable seasons. The total effect of these flare-ups will of course be declining also. Myxomatosis is still helping to keep rabbits down but, even under this season's ideal conditions, is clearly not as effective as it was earlier.

The rabbit situation, as usual at this time of the year, is rather confused but one thing is certain—there has been no noticeable overall reduction. In most places of course local populations have been greatly reduced from the normal early summer

build-up but, in comparison with the same time last year, there has not been a significant general improvement.

A tendency has been noticed for many farmers to participate in the poisoning drives in what might be described as a token manner, so reminiscent of the phosphorus poisoning days prior to 1956. They carry out free feeding in the quickest and easiest way possible without any real consideration to the need for great care and

Fig. 2.—The notice on the tree reads "Poisoned Baits Laid Here," but the dingo couldn't read

planning. This attitude probably accounts for the evident failure to place trails in the best position and to carry out free feeding properly for the full number of times.

The main result is that while some rabbits are being poisoned, too many are being left.

Another unfortunate tendency is to regard participation in a poisoning drive as the total effort for the year. This is quite wrong, as in many instances, further poisoning, warren destruction or fumigation are required also.

FOX-POISONING

The poisoning drives against foxes have been enthusiastically welcomed by the farmers involved. It has been made clear that the district-wide drives are mainly aimed at giving the fox population a severe setback before lambing. Continued year-round activity by farmers would of course assist in more permanent control, but most farmers are content with a drive to protect their lambs.

Our experience has been that, in the first drives, many farmers are rather dubious about poison baiting but, after the initial experience, the majority become quite enthusiastic. Probably the main factors leading to this change are the advice on poisoning methods given by the vermin control officers, the availability of ready-made baits at road boards, the noticeable drop in foxes and the poisoning of reserves and Crown lands by Agriculture Protection Board units. These units will continue with poisoning operations throughout the year.

WILD DOGS

The State-wide wild dog situation continues at the all-time low reached over the last few years. There can be little doubt that in most areas this has been due to the carefully directed and co-ordinated activities against them by pastoralists and A.P.B. officers.

The destruction drives conducted by pastoralists, vermin boards and road boards in the North-West, are achieving good results and the longer they are continued the more successful they are becoming with the gain in experience and knowledge of the country.

In the Kimberleys from where most of W.A's. wild dog scalps normally come it is noticeable that numbers have fallen even in the more remote areas.

This is a most interesting trend, and appears to have extended right across northern Australia. Queensland's scalps reached a peak in 1952, and then fell

Fig. 3.—Bait-making in the Kimberleys during experimental poisoning of wallabies with bran and pollard pellets containing strychnine. The baitmaking machine is on the right and quantities of baits are spread out to dry before being bagged

steadily to a very low figure in 1956. Our scalps reached the lowest figure on record in 1957, and have continued at a low level. The fluctuations are possibly part of a population cycle or have resulted from seasonal conditions. I hope the fact that last year Queensland's scalps jumped suddenly to an all-time record will not have any relationship to the position in W.A. Queensland paid for 47,000 wild dog scalps and the overall bonus payments for all vermin including foxes, wild pigs, etc., was the record sum of over £70,000. The increase was attributed to prolonged drought conditions inland driving the dogs into settlement.

One interesting point about Western Australia's scalp figures is that while the majority of wild dog scalps are produced in pastoral areas, the fluctuations in their numbers have followed the fox figures very closely although by far the majority of fox scalps come from agricultural areas. There does not appear to be any significant relationship between seasonal conditions in pastoral and agricultural areas.

WILD DONKEYS

Wild donkeys have been coming into greater prominence over recent years. They have been in pest proportions in the Eastern Goldfields, the North Eastern pastoral districts and the North-West. However, it is in the Kimberleys where they have become the greatest menace. On many stations it is claimed that there are more donkeys than cattle. An estimate has been made that each donkey eats twice as much feed as one head of cattle, so the seriousness of the situation is apparent. It becomes even more acute under extremely dry conditions as the donkeys will beat the cattle to available water.

Water poisoning cannot be used extensively under Kimberley conditions and shooting is the only control measure at all effective. As the danger has become apparent, more and more stations have been active against wild donkeys. Unfortunately, with a pest so mobile, activity by stations individually has little effect and co-ordinated overall drives are the

only possible solution. The Agriculture Protection Board is assisting in the organisation of drives in the Eastern Kimberleys and at the eastern end of the West Kimberley area. The stations and road boards will be conducting the main organisation themselves with the guidance and advice of Agriculture Protection Board officers. The Protection Board will also help with men and ammunition. It is hoped that when the results obtained by co-operative efforts are seen, this type of control drive will be just as enthusiastically carried out annually as it is against other vermin in other parts of the State.

KANGAROOS

Kangaroos continue to cause concern, and reports of their depredations are being received from various parts of the State. In the West Kimberleys where wallabies concentrate in big numbers along the Fitzroy River, some of the stations took advantage of the dry conditions last year to conduct poisoning campaigns. Investigations by Protection Board officers had shown that baiting was possible but only in drought seasons and the success obtained certainly confirmed this finding.

The two-year open season for grey kangaroos in the lower southern agricultural districts will close soon and consideration will no doubt be given to an extension of a further year. It is interesting to note what has happened so far during the open season. From reports being received from some districts kangaroos are still doing just as much damage as before. In others, particularly where organised shooting has been conducted, there has been considerable improvement.

Western Australia with its area of a million square miles has many and varied vermin problems. With so much unsettled and remote land including ideal breeding and living places there is a continuous reservoir of pests ready to move in. The only reasonable approach to control under these circumstances is to use all the available resources including farmers, pastoralists, local authorities and the Agriculture Protection Board in carefully-planned positive co-operative and co-ordinated efforts, and this is the policy the Protection Board is endeavouring to apply.

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